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A. A. Gray, General Manager. H. S. Tuthill, Business Manager.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Bus. Mgr.

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Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
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HOW CAN ELECTRICAL CONSTRUCTION BE IMPROVED?

Considerations of hazard to both life and property through defective electrical wiring have led to the formulation of rules covering this form of construction work which are in force through municipal ordinances in nearly all of the cities of this country. In territory not covered by such ordinances the requirements of the fire underwriters have led to the general acceptance of similar rules, embodied in the National Electrical Code. This Code and the various municipal codes aim to keep all electrical construction work up to at least the minimum requirements which they specify, and the attainment of this degree of excellence is enforced through inspection, which may be more or less rigid, by either municipal inspectors or inspectors representing the fire insurance companies.

This system of requirements and inspection offers no inducement whatever for any grade of work better than the minimum which will meet the requirements of the Code and of the inspector, and, indeed, it becomes sometimes a matter of difficulty for the inspector to be sure that even these requirements are met. In many localities work is done by men who have not a thorough knowledge either of the Code requirements or of the important considerations which should govern in case of special construction work, or, indeed, even of the fundamental requirements for an ordinary job. Any restrictions which can be placed upon the method of doing this work which will tend to insure a higher grade of work are, therefore, desirable.

The general public has an interest in fixing the conditions which will insure a higher grade of work, both on account of the general hazard involved and also as individual owners of property in which the work is installed. The architect and the builder are interested because better conditions would enable them to be more sure of getting good work done and in having their specifications properly carried out. The electrical contractor is interested because any restrictions which will necessitate high-grade work will remove the competition of incompetents and also of those irresponsible persons who are likely to underbid on contracts on the expectation of being able to so skimp the work as to come out with a profit. The central station is interested because the better the grade of work in electrical installations the fewer will be the accidents and the better the repute of electric service. The electrical manufacturer is interested because the necessity for better work will increase the demand for the better

grades of apparatus and materials. The electrical inspector is interested because his work will be less arduous when the installation of high-grade work does not depend entirely upon his own watchful eye and continuous supervision of the installation. It is evident then that all interests in the electrical industry would be benefited by any conditions which would necessitate better electrical construction.

Realizing the possibility and the benefits of such a condition, some communities have made it illegal for anyone to do electrical construction work who has not the proper qualifications and experience to appreciate and to do good work. Under such regulations only those who have secured a license from the municipal or state authorities are permitted to undertake electrical construction, and it is aimed to issue licenses under such conditions that only competent persons can secure them. It may be well to inquire what requirements will restrict licenses to men who are thoroughly competent.

In some municipalities it is necessary for the contractor or master electrician to pass an examination which will demonstrate his fitness, and this may be regarded as the most certain means of insuring the requisite ability and knowledge. In some cases a monetary deposit or bond is required, which will be forfeited in case violations of the regulations are discovered. While such a provision will not protect against ignorance, it will serve as a deterrent against the willful installation of inferior work. A similar deterrent is to be found in the revocation of the license for like cause. This provision not only has all the merit of the last but would serve to soon eliminate from the business the incompetent contractors whose errors are made through ignorance. In other cases, a registration fee is required of the licensee, but it is difficult to see how this has any influence upon the grade of work which will be performed. Since this money is not returnable in any case, it does not have the influence of a forfeit and would have little effect upon the work of either the dishonest or the incompetent contractor. Its principal benefit would be to exclude from local contracts men whose principal business is in other localities and who could not afford to take out a license to do a single job. From this point of view it may be of some benefit, since local regulations vary somewhat and the outsider is not likely to be so familiar with them as is the resident contractor. The same object is attained by requiring a permanent local place of business.. In some places a certain amount of experience is necessary, as represented by work at the trade for a given number of years before a license can be secured. While this is a good provision, it is likely to be evaded if affidavits are depended upon to insure compliance with the provision, since it has been demonstrated in many other relations that if one does not look behind an affidavit very little reliance can be placed upon its statements.

As to whether it is generally more desirable to require registration and a license of all persons engaging in electrical work than to require this only of persons in responsible charge of such work, there is room for question. Those who favor the latter plan sometimes contend that even where an electrician known to be competent is making changes in wiring or installing new wiring, and doing the work himself, a second man, who is licensed or registered, should be employed to act in a supervisory capacity. Such a scheme would call for extraneous supervision of much of the work the electrician in a large hotel, theater or industrial plant has to do. It is hard to see why in such cases the man who actually installs the work should not himself be registered and be responsible for the quality of the work.

Summing up the various qualifications for a license, it would seem that competency can best be insured by an examination, or when this is not considered desirable, by a penalty of some kind such as annulling the license or forfeiting a deposit for an infraction of the rules. The payment of a license fee can have but little effect in attaining the desired purpose.

INCIDENTAL FEATURES OF OFF-PEAK POWER CONTRACTS.

The use of off-peak power contracts is deservedly growing in favor among central stations which realize the benefits of selling energy at times when a considerable portion of the investment in machinery and distributng facilities would otherwise be earning little or nothing. Within the past five years the load curves of many stations have been wonderfully improved by this means and handsome profits added to the ordinary revenues in numerous instances. There are certain incidental features of this kind of service, however, which should not be lost sight of in efforts to increase the business of a central-station organization, features which strongly emphasize the need of very careful study of each situation to which off-peak rates are to be applied. Hasty generalizations along this line of practice are very good things to sidestep.

Hard-headed business sense should cause the central-station manager to go slowly in recommending any particular class of rates for a given installation until a thorough power survey has been made on the ground. It is not enough to take the prospective consumer's word for it that his power conditions immediately fall within the class entitled to the lowest unit rate, unless such statements are backed up by indisputable evidence of an engineering character. Adequate preparation is required for the best results in every activity of modern life from raising chickens to capturing a power franchise, and in few cases is there any permanent loss through taking a reasonable time for investigation. It pays to figure the probable bills of the prospective consumer of power in more than one way and according to more than one schedule of probable use, in cases where the yearly

income runs into the hundreds and thousands. It is surprising how many factors should be taken into consideration in making up a suitable power contract, such as its life, terms of extension, period of use, continuity of service, limitations of hours, load-factor and many other points which any suitable scheme of rates needs to realize in order to safeguard the prosperity of the company. The conditions differ so widely in industrial establishments that it is not surprising that an off-hand price cannot at once be given in many instances for a desired service. Familiarity with the load and its hours of use must precede any intelligent quotation of price and because a grain-elevator owner comes into the manager's office seeking a power price based upon an idea of what a competitor is paying is no reason for justifying his off-hand estimate for his own installation unsupported by adequate investigation. The situation is utterly different from supplying residence lighting and small power. In other words, because Smith pays the company $100 a month for power on the off-peak schedule, it by no means follows that Brown, in the same line of manufacturing, but with 50-per-cent larger output of product, will have to pay $125, or any other such approximated sum. Before Brown's rate can be figured properly, a detailed study of his load conditions, his type of machinery, arrangement of plant and the way it is handled must be considered.

Without enlarging upon aspects of off-peak contracts which apply generally to power agreements, the experience in a typical case where an accident occurred at the end of the power-using season is suggestive. Energy was supplied at an off-peak rate to a brick-making concern through a 13,000-volt line carried across the manufacturer's premises at a height of some 25 feet above the ground and terminating at a substation where the usual metering and transformer equipment was installed for motor service. In the fall, when the brick plant had been shut down, employees prospecting for clay in the ground under the incoming line carelessly brought the handle of a long metal drill against the wires in withdrawing it from the test hole, and fatal results followed. The power company was not held responsible for the accident, as the drill was being handled by the direction of the superintendent of the brick company. The latter had telephoned the power company some days before that the season had ended and that the supply of power on the summer off-peak basis would not be required until the next year. The power company was only incidentally a party to the accident and the legal responsibility was placed by the courts upon the brick concern. The occurrence brought out the point, however, that if suitable disconnecting switches had been installed in the line, it would have been possible to cut out the off-peak service substation without interfering with the service of consumers farther away from the generating station, a condition which was largely the cause of the maintenance of full line pressure on the substation feeder circuit. In the supply of power to industrial concerns on the off-peak basis, it is important to anticipate the effect of shutting down the service upon other users and to bear closely in mind the responsibility and limits of authority over the equipment of each party. Had the contract in this case placed the responsibility for cutting off the service upon the power company, it would have been much more difficult to have met the situation which developed, although it arose from gross carelessness on the part of the power user. Both the discontinuance and the resumption of service are important in respect to the mutual relations of the central station and the consumer in contracts of this character.

Another point to be kept in mind in offering an off-peak rate is the possibility of overdoing the acquisition of load to fill up the valleys in the load curve. The entire justification of an especially low rate for off-peak service lies in the proposition that it shall never cause the capacity of generators, transformers, feeders, etc., otherwise necessary, to be taxed to their limits. If, however, the conditions of power demand should so change during the life of a contract that valleys in the present load curve should be entirely filled up, the justification for a low rate would no longer exist. In other words, the business attracted by an off-peak rate must not be so large as to cause a new peak, nor indeed to come even close to the present one. For many stations permit the equipment to carry a load at the time of peak which could not be carried continuously without injurious heating. And even though contracts are for limited terms, it must be regarded as an unwise policy to inaugurate a rate which may have to be withdrawn at a later period.

Such a contingency as this may seem very remote, and in many communities there is no likelihood of having the peak ever determined by anything except the lighting load. In other places, however, the possibilities in this direction are not to be despised. Many central stations already have power loads equal to or greater than the lighting load. Since the two overlap, however, the peak is still determined by the lighting load. But if an off-peak load of similar proportions were cultivated, the lighting load would no longer determine the maximum. The possibilities for such loads are to be found in electrochemical processes, ice-making, vehicle-battery charging, heating and cooking. Who can forecast the developments in power application in the next ten years? One can at least conceive of a condition such that the designation of a particular time of day by the manager as an off-peak period carrying bargain prices would immediately result in placing the peak at the appointed time.

Central-station managements there are who realize the possibilities in this situation so keenly that they have steadfastly refused to offer any special price inducements for off-peak loads.

Pittsburgh Company Section Banquet.

The Duquesne Light Company Section of the National Electric Light Association held a dinner on May 9 at the Rittenhouse, in Pittsburgh, Pa. Over 500 members and guests were present and listened to addresses on electrical subjects, with C. W. Ward presiding. The chief address was made by A. L. Powell, of the General Electric Company, who spoke of the manufacture of incandescent lamps and illustrated the subject with pictures taken in the factories.

An address, "Ten Years of Progress," was made by W. A. Donkin, general contracting agent of the Duquesne Light Company.

The local section of the national association has been progressing steadily during the last several months. A section monthly magazine is now being published and distributed to the members. At the dinner of the section plans were formed for the holding of a picnic at Homestead Park on June 21, at which baseball and track events will compose the athletic program, with band concerts and dancing.

Allis-Chalmers Reorganization Complete.

On April 16, 1913, Allis-Chalmers Manufacturing Company took over the properties and entire operation of the business of Allis-Chalmers Company, which during the past year has been in the hands of a receiver. This change marks the end of the Allis-Chalmers receivership and the commencement of the administration of the new company.

Beginning with April 16 all business has been and will be conducted by Allis-Chalmers Manufacturing Company, which starts out under conditions promising success. The new company will operate all departments of the business as conducted by its predecessor and will carry out all contracts on hand for the sale of its products. It has no bonded indebtedness nor liabilities of any character. In addition to all assets of the former Allis-Chalmers Company, the new company has over $4,000,000 additional in cash for new working capital, which has been raised through the recent reorganization.

The new company will continue to operate the large West Allis Works and Reliance Works at Milwaukee, the Chicago Works, and in addition will control the operations of the Bullock Electric Manufacturing Company at Cincinnati. Otto H. Falk, of Milwaukee, who for the past year has been receiver of the Allis-Chalmers Company and under whose management as receiver the operations of the business have shown marked improvement, has been elected president of the new company. The general offices will be at Milwaukee.

All properties of the new company are in good condition and its inventories and working capital on a sound basis. Its engineering departments are well equipped and the various lines of product now turned out are of the highest quality. Under these conditions it is believed that with the present careful and intelligent management the operations will show substantial profits.

Announcement has been made by Frederic Nicholls, president and general manager of the Canadian General Electric Company, that negotiations have been concluded with the Allis-Chalmers Company of Milwaukee, and the Allis-Chalmers-Bullock Company, of Montreal, by which the Canadian General Electric Company acquires all the properties and assets of the Allis-Chalmers-Bullock Company in Canada. An agreement has also been made which gives the exclusive right to manufacture and sell in Canada the types of apparatus for which the Allis-Chalmers Company has a reputation, such as Corliss engines, water wheels, mining machinery, gas engines, etc.

The business will be conducted under the name of the "Canadian Allis-Chalmers, Limited," a charter having been applied for. Mr. Milne, manager of the Allis-Chalmers-Bullock Company, will continue as manager of the new company.

Annual Convention of Oklahoma Association.

The Oklahoma Electric Light, Railway and Gas Association held an unusually well attended and profitable convention in Oklahoma City on May 7 and 8. Oklahoma City was selected as the permanent headquarters of the association and the following officers were elected for the coming year: President, F. E. Bowman, Ada Electric & Gas Company, Ada; first vice-president, Lincoln Bierbower, Enid; second vice-president, George W. Knox, Oklahoma Railway Company, Oklahoma City; secretary-treasurer, H. V. Bozell, Norman; directors, H. S. Cooper, Weatherford; W. H. Bagley, Tulsa; H. D. Long, Muskogee; H. S. Dawson, Okmulgee.

These permanent committees were named:

Membership: Galen Crow, Guthrie; A. V. Hancock, Oklahoma City; D. R. Detwiler, Oklahoma City; L. A. Griver, Stillwater.

Entertainment and Program: F. W. Insull, Oklahoma City; W. R. Molinard, Oklahoma City; W. J. House, Oklahoma City; H. V. Bozell, Norman.

Public Safety: J. J. Johnson, Oklahoma City; J. J. Steffins, Tulsa; Galen Crow, Guthrie.

Public Policy: F. H. Tidnam, El Reno; Edward Howell, Shawnee; George W. Knox, Oklahoma City.

Relations to Consumer and for Improvement of Service: N. R. Gascho, Alva; F. W. Caldwell, Shawnee; Henry Wilmering, Oklahoma City.

Accounting: H. Wilmering, Oklahoma City; F. E. Bowman, Ada; John Williams, Shawnee; L. A. Garner, El Reno.

Fuel and Efficiency: A. G. Johnson, Chickasha; H. B. Dwight, Norman; F. E. Hunter, Oklahoma City; L. G. Purtee, Oklahoma City.

The members of the association made an excursion to Norman during the meeting as guests of H. V. Bozell, secretary of the association, who is professor of electrical engineering at the state university, to inspect the engineering school and its equipment.

The Central Station Institute.

The demand for trained men for the sales and other commercial departments of the large electrical interests of the Middle West led to the establishment of the Chicago Central Station Institute, according to Fred R. Jenkins, secretary, who briefly outlined the objects and benefits of the school before the Jovian Lunch Club of Chicago, on May 12. It is the intention of this Institute, he stated, to so train its students both by classroom work and actual outside experience, that they may be better equipped to represent any central station in its commercial departments at a saving of some years of the student's time.

Telegraph Extension in Newfoundland.

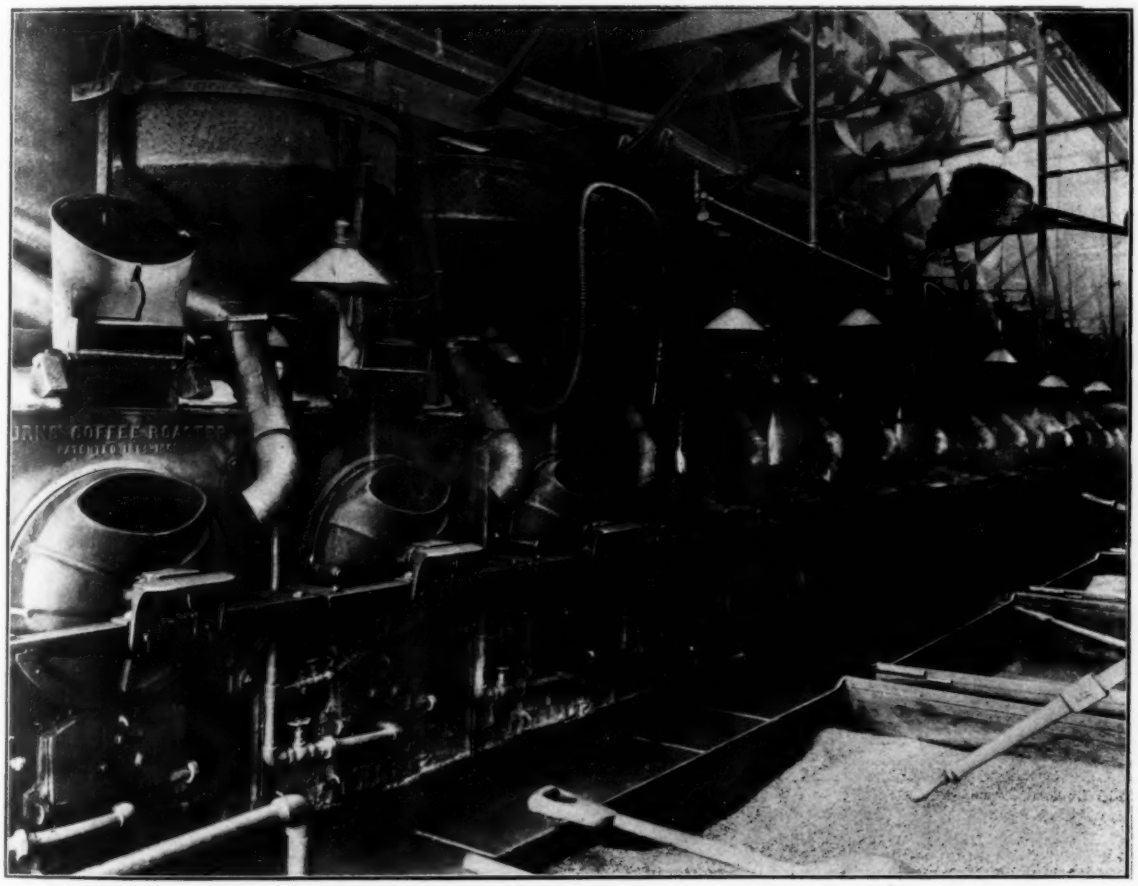
The Newfoundland Government proposes to extend the telegraph system around the seaboard of the island, 500 miles having been built in the past four years, with a prospect of 250 more being constructed during the present season; also to build three more wireless stations on Labrador and to establish a telephone system for St. Johns and a number of the outlying places.

The wireless station at Cape Race was destroyed by fire on the night of May 5. A spark from the sending apparatus was the cause. The wooden building in which the instruments were housed was ignited and the blaze spread too rapidly to be controlled. The aerial tower was not damaged, but the loss is estimated at $10,000.

Electricity in Coffee and Spice Mills.

Coffee-roasting and spice-grinding plants provide desirable loads for central-station power service on account of the absolute necessity for cleanliness in such plants and because of the continuity of the load. The hesitancy shown by plants in this industry to purchase power is rapidly disappearing and progressive central stations are now encountering no difficulty in securing this class of business.

Coffee roasting and spice-grinding plants provide desirable loads for central-station power service, on account of the considerable number of machines requiring substantial amounts of electrical energy for continued operation, the necessity of maintaining conditions of maximum cleanliness inside the mill, and the tendency of such establishments, particularly the coffee-roasting departments, to run upon a long-hour basis. The work is, in the main, of constant-speed characteristics and the induction motor has become strongly intrenched in this field which is one of the most attractive at present offered the central-station power salesman.



Battery of Burns' Coffee Roasters in Plant of E. B. Millar & Company, Chicago. Driving Mechanism in Rear.

In recent years there has been a marked tendency on the part of manufacturers to improve sanitary conditions in their establishments. Particularly in plants where food products are manufactured or handled has this tendency been noticeable, and today it is gratifying to observe that practically all manufacturers are keenly alive to the desirability of maintaining a high standard of cleanliness in their factories.

In coffee and spice mills it is, of course, literally imperative to maintain clean surroundings so as to prevent foreign substances entering the various ingredients. The absence of belts and shafting, elimination of greasy bearings, frequent adjustments of the driving mechanism by mechanics on step-ladders, reduced inspection and independence of the motor drive in the face of the most trying atmospheric conditions, are important advantages. In fact, it would seem that the question of cleanliness is alone of sufficient importance to justify the adoption of motor drive in this industry.

There are many other advantages of electric motor drive and central-station power that apply specifically to coffee and spice mills. In the first place, spice and coffee-mill machinery usually extends through several floors, since full advantage is taken of gravity in handling the product in modern mills. In this connection attention is directed to the flexibility of motor drive. Electric energy can be economically transmitted to remote locations and transferred to mechanical at the point of application in any quantity desired. When compared with line shafting and belts, the installation of wires for carrying electric current is a very simple and inexpensive operation and in comparing the relative losses in transmission, the electrical losses seem almost insignificant. Also, with motor drive

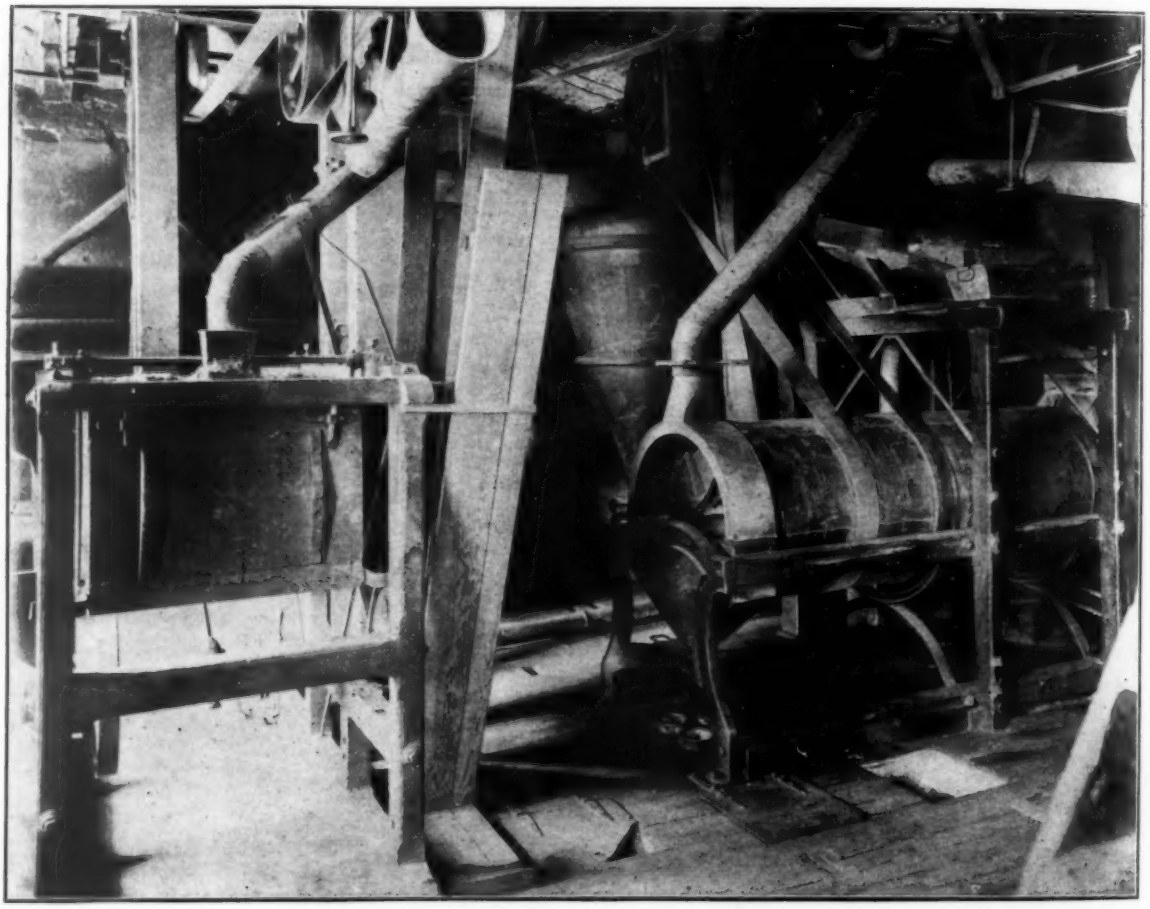
the location of the various machines and even of the buildings themselves is practically unhampered by considerations of power and even after installation a motor-driven machine can be moved from one location to another, as a unit, without disturbing or interrupting any other machines.

Uniform speed and reliability of supply are two of the strongest arguments that a central-station salesman can advance and both features are of the utmost importance in coffee and spice mills. This is more fully realized when it is considered that a single charge of coffee in a battery of about a dozen roasters may be worth $500—a sum easily sacrificed if the speed of the revolving cylinders is not maintained uniformly throughout the process, with the possibility of quick control in starting and stopping—particularly an advantage of motor drive.

In coffee roasting, the various operations involved, such as elevating green coffee; cleaning, stoning, and grading; roasting; and grinding are more or less continuous and dependent one upon the other. In spice grinding, however, this condition does not exist, the operation of the various grinding mills and sifters being intermittent. A motor-driven machine consumes energy only while operating, and then only in proportion to the work done. Therefore, when central-station power is used, all power costs stop when the machines are idle. Moreover, the use of motors eliminates some or all the losses due to friction of line shafts and belts. These losses consume anywhere from 30 to 60 per cent of the energy required to operate an ordinary shaft-driven mill, and they are continuous, even though only a few of the machines are operating. As very few of the spice grinding machines are in use more than half of the time, the cessation of all energy losses chargeable to each machine, except while it is in productive operation, constitutes a very large saving in power.

Another feature in conection with the use of motors in coffee and spice mills that is of particular importance is the reduction of fire risk when electricity is used. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or belt or rope transmission. If central-station power is used all danger from an adjoining power plant is removed and the use of motors does away with the inflammable dust inevitably carried into the boiler room by belts. The elimination of heavy line shafts, also, greatly reduces the danger of fire from overheated journal boxes or from spontaneous combustion. It should be remembered that the rate charged by insurance companies where steam boilers are in close proximity to the working machines and product, is exceedingly high and that by installing complete electrical equipment in a modern fireproof building the annual premiums may be reduced from perhaps 7 or 8 per cent to three-quarters or one per cent. In quite a few cases this saving in premiums has gone far towards making up for the original cost of the electric installation.

The grinding of spices and coffee creates considerable dust which is difficult of removal and for such service there is no question that the induction motor has unique qualifications. The coffee-



Group of Coffee-Cleaning Machines in E. B. Millar & Company Plant.

Coffee Roasting Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Coffee-roasting plant operating five hours per day.

Total connected horsepower, 5.5. Total number of motors installed, 2. Average kilowatt-hours per month, 244. Average kilowatt-hours per month per horsepower connected, 44.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
January	208	May	264	September	197
February	200	June	404	October	197
March	220	July	333	November	161
April	192	August	272	December	229

Load-factor, 8.1 per cent; operating-time load-factor, 34 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	5	1,200	Geared to one coffee roaster, and one extracting fan.
1	0.5	1,200	Direct-connected to one double-head coffee grinder.

Small coffee-roasting plant, operating 54 hours per week.

Total connected horsepower, 7.5. One shunt-wound direct-current motor is installed. Average kilowatt-hours per month, 294. Average kilowatt-hours per month per connected horsepower, 39.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
January	292	May	294	September	280
February	264	June	305	October	353
March	269	July	313	November	331
April	262	August	299	December	272

Load-factor, 7.2 per cent; operating-time load-factor, 17 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts, direct current.

No.	Horsepower.	Speed R. P. M.	Application.
1	7.5	1,450	Belted to a line shaft driving one Monitor No. 21 coffee milling machine; one bag coffee roaster and blower; and one small grinder.

Coffee roasting and spice mill having an average output of from 40 to 50 tons per day. The entire production is packed in paper packages for retail distribution. The coffee machinery operates 10 hours per day while the operating time of the spice department varies each week.

Total connected horsepower, 77.5. Total number of motors installed, 7. Average kilowatt-hours per month, 7275.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
May	4,970	September	5,950	January	7,900
June	6,090	October	5,800	February	9,600
July	5,580	November	6,170	March	7,810
August	6,180	December	7,320	April	13,940

Load-factor, 17 per cent; operating-time load-factor, exclusive of spice machinery, 48 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type, with the exception of the one operating the freight elevator.

No.	Horsepower.	Speed R. P. M.	Application.
1	10	1,120	Slip-ring motor geared to mechanism of a 2,000-pound-capacity freight elevator.
1	30	1,120	Belted to a line shaft driving one Schultz-O'Neill pulverizing spice mill; two Schultz-O'Neill sifters; one spice breaker, and one four-roll spice mill.
1	10	690	Geared direct to Burns coffee roaster.
1	10	1,120	Belted to a 20-foot line shaft, five hangers, driving one coffee stoner; one mixing tank for blending coffee, and one Hedfeldt coffee cleaner and separator.
1	15	1,120	Belted to a line shaft driving two 36-inch Sturtevant fans.
1	0.5	1,200	Belted direct to a bucket elevator for raising coffee from first floor to roaster on top floor.
1	2	1,700	Belted direct to a small cylinder press for printing labels, etc.

Coffee Roasting Data—Sheet No. 2.

Coffee and spice mill handling on an average of 90 tons of coffee per day. This output is all packed in cartons or tins and distributed to the retail trade.

Total connected horsepower, 101.5. Total number of motors installed, 13. Average kilowatt-hours per month, 3929.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
May	3,900	September	5,400	January	3,800
June	2,980	October	4,760	February	2,000
July	3,680	November	5,360	March	1,800
August	6,080	December	5,480	April	1,900

Load-factor, 7.1 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. All motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
2	10	690	Each belted to a line shaft driving, through bevel gears, eight coffee roasters.
2	7.5	1,120	Each belted to a 45-inch cooling fan for coffee roasters.
1	7.5	1,120	Belted to a line shaft driving stoner and chaff fan.
1	10	1,120	Belted to line shaft driving one coffee cleaning machine; two screens; two sifters, and one bucket elevator.
1	15	1,140	Belted direct to one Schultz-O'Neill "Limited' pulverizing mill, for spices.
1	10	1,120	Belted to a line shaft driving one Schultz-O'Neill gyratory spice sifter, running at a speed of 340 revolutions per minute; and one cracker mill, for cinnamon.
1	20	1,120	Belted to a line shaft driving one Schultz-O'Neill gyratory spice sifter; one four-roller spice mill, and one stone mill (seldom used).
2	1	1,120	Each belted direct to a small job press.
1	1	1,700	Belted direct to one Challenge paper cutter.
1	1	1,700	Belted direct to a cylinder press.

Coffee and spice mill. This is a large concern handling coffee, spices, etc., the latter being prepared from the raw material and distributed to the retail grocery trade. There are 30 men and 30 girls employed, working 10 hours per day.

Total connected horsepower, 68. Total number of motors installed, 10. Average kilowatt-hours per month, 3,124.

Kilowatt-hour consumption for 12 months:

Month.	Kilowatt-hours.	Month.	Kilowatt-hours.	Month.	Kilowatt-hours.
May	3,148	September	3,065	January	3,075
June	3,137	October	3,777	February	3,385
July	2,403	November	3,628	March	2,811
August	2,830	December	3,336	April	2,889

Load-factor, 8.4 per cent; operating-time load-factor, 18 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycle, 220 volts.

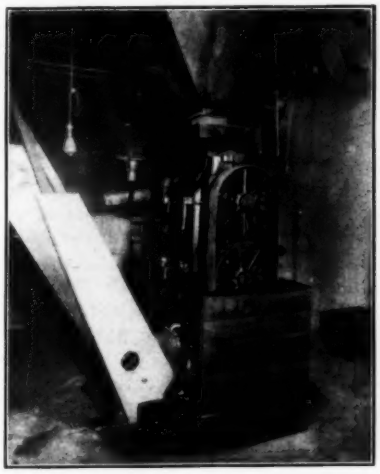
No.	Horse-power.	Speed R. P. M.	Application.
2	7.5	750	Each geared to mechanism of a two-ton freight elevator.
1	10	690	Squirrel-cage motor geared to Burns coffee roaster.
1	10	1,120	Squirrel-cage motor belted to a 30-foot line shaft, six hangers, driving one coffee cleaner and separator, made by the Hedfeldt Company, Chicago; one coffee mixer, similar to tumbler, six feet long; and one coffee stoner.
1	15	1,120	Belted direct to a 20-foot line shaft, four hangers, driving two Sturtevant 36-inch blowers; and one 15-inch blower.
1	10	1,120	Belted to a 20-foot shaft, three hangers, driving one pepper grinder; one spice packer which shreds spice roots into small particles; one spice mill; and one spice pounder, which is used to crush spice of an oily nature.
1	5	1,120	Belted to a 30-foot shaft, four hangers, driving one mustard mill; and one baking-powder mixer.
1	1	1,700	Belted direct to one Challenge paper cutter.
1	1	1,700	Belted direct to one cylinder press.
1	1	1,700	Belted to two small jobbing presses.

mill load is not usually one of severe fluctuations, the processes of roasting, hoisting, blowing, sorting, and packing being unusually even and continuous in character. The squirrel-cage type of motor is therefore recommended, principally because of the absence of commutator and the trouble and danger resultant therefrom where inflammable dust is present.

The power requirements of the coffee and spice mill are sufficiently attractive to earn a low monthly rate per kilowatt-hour. Thus, a 75-horsepower motor will drive a group of separating and grading machines and a bucket elevator running through five or six stories, serving roasters with a capacity of from 30 to 40 tons of coffee per day. Eight roasters may be driven in groups by a 10 horsepower motor, under normal conditions, and other power requirements drawn from practice are approximately as follows: Label presses, two horsepower each; gluing and folding machine, three horsepower; freight elevator, capacity two tons, 15 horsepower; 45-inch cooling fans, in connection with roasters, 7.5 horsepower each; stoner and chaff fans, 7.5 horsepower each; package elevator, 100-pound trays, six stories, two horsepower; revolving screens, one-half horsepower each; four automatic weighing machines, five horsepower total; screeners and sifters, one-half horsepower each.

In the spice-grinding department a 10-horsepower motor is required on the average for each of the following machines, cayenne-pepper mill and bucket elevator; vertical spice grinder, pepper sifter and pulverizer, and feeding and sifting equipment.

While the power demands will vary somewhat according to the local conditions and the extent to which group driving is employed, they are at least approximately indicated by the foregoing figures, drawn from an unusually well equipped mill, whose proprietors, like practically every other industrial user of electricity, could not be persuaded to revert to the old mechanical methods of operation.



Motor-Driven Spice Mill.

There is no doubt that future work of this type will witness a still larger application of individual induction motors to a service for which they are so specially desirable. From the standpoints of cleanliness and reliability alone, the motor drive is a potent factor in the success of the modern coffee and spice mill.

In the accompanying sheets are given data on the motor installation and kilowatt-hour consumption of several typical plants purchasing power from central-station companies.

Boston Edison Adopts Pensions.

The Edison Electric Illuminating Company of Boston has inaugurated a system of pensioning its employees. There are three classifications:

(*a*) Providing for the retirement of male employees at 65 years of age, and female employees at 60, after 15 years of continuous service, to be retired on the employee's request, or at the direction of the Committee in charge.

(*b*) Male employees 60 years of age with 20 years of service, and female employees 55 years of age with 20 years of service, to be retired at the discretion of the Committee.

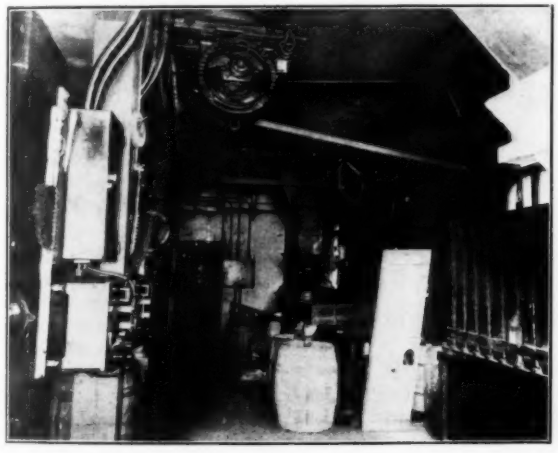
(*c*) Employees who have completed 30 years of continuous service irrespective of age, also at the discretion of the Committee.

The minimum annuity is $300. Otherwise the annual annuity will be one per cent of the average annual pay during the last ten years of active service multiplied by the number of years in service. The payments will be made monthly. There are now more than 1,600 persons in the employ of the company.

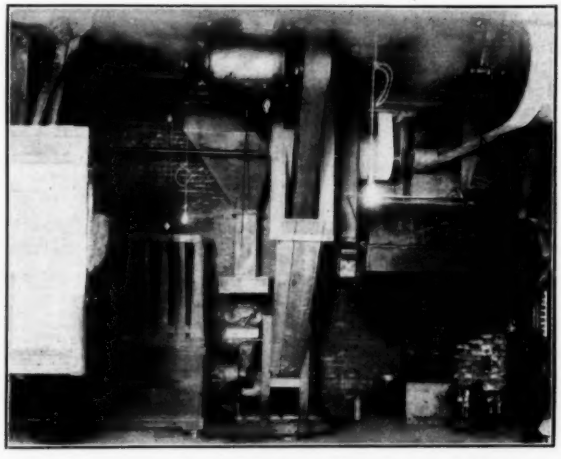
The following constitute the committee which has charge of the pensions: Charles L. Edgar, Walter C. Baylies, Thomas K. Cummins, Frederick Manly Ives, Herbert W. Moses.

Central-Station Service for Flour Mill.

The Ballard & Ballard Company, well known flour millers of Louisville, Ky., have decided to install a separate department for packing flour in paper boxes and have contracted for use of current supplied by the Kentucky Electric Company, of that city. Flour in pasteboard packages is the result of a new idea in demand for food products prepared in a sanitary fashion, generally speaking, and the Louisville millers have decided to make especial play for trade along this line. A motor installation suitable for machines which will fill cartons at the rate of 60 per minute is planned.



Group of Motor-Driven Spice Machines.



15-Horsepower Motor Driving Spice Mill and Sifter.

Commercial Practice
Management, Rates, New Business

Cost of Manufacture in a 2,300-Kilowatt Central Station.

The following facts and figures were taken from the operating records of an electric light company serving an Eastern manufacturing city of about 40,000 people for the year ending June 30, 1912. The company operates a steam plant of 2,000 kilowatts capacity, and a 300-kilowatt hydroelectric plant situated about two miles from the station. The general practice is for the smaller plant to operate the Sunday load and to supply for two hours on other days during the peak load, from 250 to 300 kilowatts. The hydroelectric property was acquired during the year 1912.

The equipment of the steam plant comprises five Stirling water-tube boilers rated at 250-horsepower each, and three vertical cross-compound McIntosh & Seymour engines of 650,-950 and 1,500 horsepower direct-connected to 2,300-volt alternators of 400, 600 and 1,000 kilowatts capacities, respectively. The hydroelectric equipment consists of a 44-inch Pelton wheel operating under a working head of 187 feet direct-connected to a 6,600-volt alternating-current generator of 300 kilowatts capacity.

The company generated 3,679,350 kilowatt-hours, a gain of about 52 per cent over that of the previous year, and purchased 1,107,550 kilowatt-hours at approximately 0.5 cent per kilowatt-hour. The total number of kilowatt-hours delivered at the switchboard was 4,786,900, an increase of nearly 22.4 per cent compared to that in the former year. The net cost of manufacture per kilowatt-hour was 1.31 cents, which is a reduction of 20.1 per cent over that of the year before. The cost of manufacture does not include distribution, office expense and management, taxes and miscellaneous expense. The maximum station load during the year was 1,880 kilowatts, giving a load-factor of 48 per cent on the day of the peak.

The cost of fuel, consisting principally of steam coal at $4.38 per ton, was $28,826.64, making the fuel expense per unit generated 0.78 cent, which is 0.17 cent less than that in the previous year. The labor cost per kilowatt-hour was 0.37 cent against 0.47 cent of the year before. The total labor cost of $13,416.22 was distributed among one chief engineer, three assistant engineers, three oilers, three firemen and two helpers. The oil and waste, water, tools, station repairs, steam plant and electrical equipment repairs amounted to 0.16 cent per kilowatt-hour, compared with 0.22 cent for the former year. About 36 per cent of the kilowatt-hours delivered at the switchboard was sold for power. The total connected power load amounted to 2,157 kilowatts with 374 commercial motors in service, compared with 1,686 kilowatts and 372 motors of the previous year. The total connected lighting load was 1,627 kilowatts, an increase of 29.6 per cent of the year before. A gain of 16.4 per cent was made in the number of customers, making a total of 1.68 for the year ending June 30, 1912. The reduction in the unit cost of manufacture was caused principally by the increased output.

The tabulated data are as follows:

Cost of manufacture for the year ending June 30, 1912:	
Fuel cost (per kilowatt-hour at 0.78 cent)	$28,826.64
Oil and waste	603.89
Water	918.69
Station wages (per kilowatt-hour at 0.37 cent)	13,416.22
Station building repairs	320.08
Steam equipment repairs	2,536.07
Electrical equipment repairs	202.94
Station tools and appliances	690.07
Total	$48,014.60
Kilowatt-hours delivered at the switchboard	4,786,900
Kilowatt-hours purchased	1,107,550
Kilowatt-hours generated	3,679,350
Kilowatt-hours sold for power	1,720,362

Flat Rates for Small Customers in Cedar Rapids.

The flat-rate method of charging is being successfully used by the Cedar Rapids & Iowa City Railway & Light Company, as an entering wedge in securing small lighting customers having a maximum demand varying between 100 and 300 watts. The company finds this method particularly desirable in the case of the small offices, which, under the meter rates seldom justify the investment necessary. Several customers of this class are now proving profitable although consuming only two or three kilowatt-hours of energy per month.

In the case of residences, the flat rate has never been continued over three months and meter customers are thus secured which would be impossible without the flat-rate method.

Systems of Charging for Domestic Supply.

Three more electric supply engineers in England have been admitted to membership in the Point Fives Club, making the number thirteen. These three engineers have all this year introduced in connection with their systems (Sheffield, Accrington and Wrexham) the Norwich system plus one cent per kilowatt-hour. On May 23 the members of the club will meet at the Institution of Electrical Engineers in London to discuss the standardization of electric cookers and the standardization of the taxable value plus one cent per unit tariff for domestic supplies. At the April meeting of the club, Thomas Roles, city electrical engineer of Bradford, discussed tariff matters in their relation to heating and cooking. He said that out of 918 private residences in Bradford using electricity 471, or 51.3 per cent had adopted the special domestic tariff of 15 per cent per annum upon the net taxable value of the premises occupied, plus one cent per unit for all current consumed as registered by meter, no charge being made for the hire of the latter. He gave the reason for adopting 15 per cent upon the taxable value as the fixed charge. When giving consideration to the framing of a special charge for domestic purposes, the accounts of all the private house consumers connected were totaled, and particulars of the taxable value of each of the premises obtained. It was then found that if the whole of such consumers were charged at the rate of 15 cents on the dollar on their net taxable values, plus one cent per unit for all current used, the total revenue obtained from them would be practically the same as was then being obtained under the flat rate of 8 cents per unit less 2.5 per cent discount for prompt payment. The effect of such a tariff on consumers individually was, of course, found to vary considerably. The average price per unit consumed, including the standing charge, was in the case of a number of householders as low as four cents and in some instances even lower, while other consumers, had they adopted the rate would have had to pay from 12 to 24 cents per unit. But, said Mr. Roles, it was generally found that the consumers who would benefit by the new tariff had wired their houses for

electric light throughout, whereas those who would not benefit by the rate had only wired the best rooms. Some consumers had already adopted electric heating to a small extent either on the restricted-hour rate of 1.5 cents per unit, or on the ordinary power rates, which varied from four cents per unit downwards according to load-factor. Mr. Roles expressed his extreme satisfaction at finding that on the inauguration of the rate, not only was it adopted by consumers who would immediately benefit, but a number of consumers who would only benefit by adding to their installations also made application to be charged on the new system. To these as well as to subsequently obtained consumers the most attractive feature seems to be that it is possible to ascertain definitely within a few cents the exact amount of their bills for electric lighting. Practically all the consumers who have adopted the rate have very considerably increased the illumination of their premises, and in many cases by 100 per cent.

Mr. Roles added that with all respect to fellow members of "Point Fives" who had adopted a special flat rate of one cent per unit for heating and cooking he submitted that the majority of consumers supplied on the Norwich system with one cent per unit as the running charge, were in a far more favorable position than if they were charged at one price for energy used for lighting purposes and on a one cent per unit flat rate for heating and cooking. They had the advantage of only having one meter and one system of wiring, and could increase the candlepower and number of lamps in use to any desired extent without incurring a much larger charge for the additional energy required. The percentage to be paid on the net taxable value as a standing charge must be worked out separately for each supply area, as it was likely that 10 per cent on a particular house in one area would represent a considerably larger sum than 15 per cent in another for a house of exactly similar size.

Another London Electric Restaurant.

Earl's Court Road Electric Restaurant and showroom, established by a subsidiary of the supply company serving the Brompton and Kensington district of London, England, was opened on April 30, the occasion being marked by the serving of an electrically cooked dinner at night to a company of electricity supply and technical press representatives. There is accommodation for serving about 200 customers at once.

A Timely Electric-Sterilizer Campaign.

"I find your city water full of typhoid and colon germs. Order your citizens to boil their drinking water." This telegram sent by A. W. Fisher of the University of Michigan, suggested to the Menominee & Marinette Light & Traction Company an opportunity for the sale of electric water sterilizers.

A campaign was inaugurated by J. H. Peterson, new business manager of the company and a series of "Pure-Water Talks" published in the daily papers. The accompanying advertisement, which was one of the series,

PURE WATER TALKS
TALK NO. 3
We say you need a FORBES ELECTRIC WATER STERLIZER if you insist on absolutely safe drinking water.
No Diseased Germ Can Pass Alive Thru the Forbes Electric Water Sterilizer.
A bacterial count of filtered water or "spring" water will show a large number of the bacilli of typhoid and other waterborne ailments — Hence the only safe water is sterilized water. Two gallons of sterilized water for one-half cent. Why not consult our New Business Department for further particulars it may save doctor bills.
Equipped Complete with 2 2 gal. bottles..... $28.00
with 5 gal. bottles..... $29.50
COOK WITH GAS
LIGHT & TRACTION CO.
New Business Department.
3-12-13

One of the Series of Electric-Sterilizer Advertisements.

indicates the nature of the campaign which resulted in many sales of sterilizers.

McKinley Company to Buy Oskaloosa Plant.

Negotiations are about completed for the sale of the Oskaloosa Traction & Light Company, of Oskaloosa, Ia., to the Illinois Traction Company, commonly known as the McKinley system, which also controls the Des Moines Electric Company. The Oskaloosa company has recently made extensive improvements in its plant and transmission system, the latter including the construction of a high-tension line serving farms and outlying communities.

Electrical Accidents in Coal Mines.

Out of 2,360 fatal accidents in coal mines in 1912, only 85 or 3.6 per cent were due to electrical causes.

A Contrast in Central-Station Development.

Statistical data in the central-station industry have two important uses. The first is the comparison of operating results within a single organization over a stated period. The second, and often the less trustworthy application, is the comparison of the operations of different companies within a single fixed period. On account of differences in local conditions it is frequently most difficult to make direct comparisons between companies operating under separate managements and in widely separated parts of the country, but sometimes data come to hand which permit these analyses and which lead to important and suggestive conclusions. The tabulated information printed below illustrates the remarkable difference in the operating results of progressive commercial management as compared with those of an administration in which the seeking of new business has received but little attention. Two companies are compared, located in the same state and within 40 miles of each other; both serve manufacturing communities of nearly the same total population; both produce their own electrical energy; and steam generating machinery without the advantages of hydroelectric facilities is used in each case. The tabular data cover the fiscal year 1912.

PROGRESSIVE COMMERCIAL POLICY COMPARED WITH INADEQUATE DEVELOPMENT.

	A	B
Population served	18,612	15,539
Gross earnings	$115,106	$42,717
Sales of electric power	$45,700	$2,938
Station capacity in kilowatts	2,339	400
Total connected load in kilowatts	3,509	544
Total connected power load in kilowatts	1,667	106
Number of motors on system	271	34
Number of customers	1,274	434
Number of power customers	111	28
Kilowatt-hours generated and delivered at switchboard	3,144,009	494,380
Total kilowatt-hours sold	2,401,669	424,547
Total kilowatt-hour sales of power	1,719,162	60,420
Maximum load in kilowatts (December peak)	1,450	208
Fuel consumption in tons (bituminous coal)	5,336	1,478
Gross earnings per capita	$6.16	$2.75
Average horsepower per motor on system	8.3	4.2
Average load in kilowatts on station during year	358	56.5
Average load in percentage of station capacity	15.4	14
Average cost of coal per ton	$3.80	$4.80
Details of Station Costs:		
Fuel	$20,441	$ 7,089
Oil and waste	321	213
Water	151	449
Station wages	10,763	4,714
Station and equipment repairs	3,087	1,442
Miscellaneous	118	.....
Total (at station only)	$34,881	$13,907
Kilowatt-hour cost at station only (in cents)	1.1	2.8

The station equipment of company A consisted of four boilers of 1349 aggregate horsepower rating, and five generating units, two of which were 750-kilowatt turbo-alternators, the total generating capacity being 2,339 kilowatts. The station payroll called for the services of five engineers and four firemen, and the operat-

ing steam pressure was 150 pounds per square inch. In the case of plant B, three boilers of 400 horsepower total rating are in service, with two engine-driven units of 400 kilowatts total capacity. Three engineers and two firemen were required in the plant service, and the operating steam pressure was 120 pounds maximum.

The data in the above table in a measure speak for themselves, but a number of important points which may be deduced from them are worth considering. Making due allowances for the difference in total population, it is notable that company A has over twice the per-capita earnings of B; that its total sales per capita are 129 kilowatt-hours as compared with 27 in the case of the other company; that the power customers are more than three times as numerous in company A, and that the total connected load is more than six times as great in the commended instance. The fact that there are six times as many motors on the first system as on the second speaks volumes for the relative efficiency of its management. Again, the fact that the total power sales are more than 25 times as great in the first case, expressed in kilowatt-hours, is convincing evidence of the superior commercial practice of company A. Turning to the station operation, the results of a *laissez-faire* policy are plainly seen. The second company was somewhat handicapped, it is true, by a higher initial coal cost, but despite this the difference is extraordinary in the final production total of $34,881 for an output of 3,144,000 kilowatt-hours, in A against $13,907 for about 495,000 kilowatt-hours in station B. Even allowing for the difference in fuel cost, it is safe to say that company A produced its energy at half the net manufacturing cost per unit of company B, and the influence of the low output of the latter on the labor cost is marked. Thus, the labor cost was $10,763 in company A and $4,714 in B, showing how much the output of a plant can be increased without a corresponding increase in the labor item, so long as the equipment remains substantially unchanged.

Two New Denver Signs.

There has recently been placed upon the roof of the one-story building occupied by the Fry & McGill Motor Supply Company, Denver, Colo., a sign 40 feet long and 5 feet wide. At each end of the sign is painted a duplicate of the standard size automobile wheel; hub and spokes in maroon, rim and tire in rubber color. Between the wheels the firm's name is outlined in white upon a dark background, the whole being fitted with 675 electric lights.

By a special mechanical device, at night the wheels appear to be revolving swiftly; the hubs and spokes blending to orange, the tires showing white, while the lights forming the name are alternately extinguished and relighted by a snake-like movement.

This sign is now the most conspicuous on Broadway at night.

The George Kindel Bedding and Carpet Renovating Company has placed upon the roof of its building, a sign with letters outlined on a wire screen set in an iron frame 12 by 22 feet. The sign is fitted with 700 electric lights in green, white, red and orange.

The central figure is symbolical of a robust German woman engaged in the act of beating carpets in the old-fashioned way. In her hands she holds two stout cudgels which she plies vigorously, reminding the spectator vividly of former house-cleaning methods when the carpet was thrown over the clothes line or the back-yard fence. Below her are the words: "Don't do it this way, let George do it the right way." "Right way" in this case means by the *vacuum* process.

Electric Vehicle Handbook.

A hand book that will prove of great value to automobilists, is being distributed among users of electric vehicles, by The New York Electric Vehicle Association.

The volume includes a list of charging stations in New York, on Long Island, up-state as far as Hudson, east as far as New Haven, west as far as Easton and South to Philadelphia and Atlantic City. All of these points are indicated on a map which gives the distances between points and indicates the most direct routes. Needless to say all the points in the territory are within a day's electric run of New York. In the city itself the charging stations are listed by localities.

There are also chapters describing different types of storage batteries with instructions for their care and operation. The lists, map and chapters of instruction were prepared by the Automobile Bureau of The New York Edison Company, which is co-operating with the electric vehicle dealers of the city. The book may be had by application to the association secretary, 124 West Forty-second Street.

Electric Signs Scarce in French Cities.

An American consul in one of the larger French cities, states that although electricity is quite cheap there —from 1 to 10 cents per kilowatt-hour —and although electric lights and motors are quite common, there is not a single electric sign, either stationary or "talking" on the shopping streets of cities like Marseille. There ought to be a good trade in these signs.

Large Power Contract for Commonwealth Edison Company.

The Commonwealth Edison Company, Chicago, has entered into a contract with the Universal Portland Cement Company for the supply of energy, aggregating 4,500 kilowatts, to be used at the cement compay's plant at Buffington, Ind. The contract stipulates that the company guarantee a load-factor of 85 per cent, and stay off the peak during the months of October to February.

The Universal Portland Cement Company heretofore received all its power from the Illinois Steel Company's power plant at South Chicago, a transmission line connecting this plant with Buffington. The Edison Company built a 22,000-volt, 25-cycle line from its South Chicago substation to the cement company's transmission line at Ninety-fifth Street and Lake Michigan and one of the provisions of the contract stipulates that this plant be operated in parallel with the Edison system.

Tariffs to Encourage Cooking.

George Wilkinson, borrough electrical engineer of Harrogate, England, estimates that if he could induce one-half of the householders in his town to add electric cooking and heating to their electric lighting demand, his output would advance from 863,000 to 4,000,000 kilowatt-hours. A cooking consumer takes ten times as much for cooking as for lighting. The above figures were drawn up to induce his committee to adopt the following new scale of charges in order to encourage cooking load.

A fixed charge of 25 cents per quarter per 30-watt lamp installed, each outlet to be rated at 30 watts minimum. A fixed charge of 60 cents per quarter per kilowatt installed in cooking plant and electric radiators, etc. A flat rate of 15 cents per kilowatt-hour for all electricity consumed, the tariff to be subject to 5 per cent discount for prompt payment of account. The conditions to be imposed as follows: (*a*) That the establishment shall be entirely and exclusively illuminated by electricity; (*b*) that every lamp be assessed for the fixed charge excepting the bathroom, boxroom, and one lamp in the basement; (*c*) that cooking and heating apparatus installed be equal to at least four times the total capacity of the electric lamps.

Electric motor trucks have increased in Massachusetts nearly 30 per cent over registrations for 1912, according to figures compiled by the Electric Motor Car Club of Boston.

Electrical Construction

AN INTERESTING INSTALLATION OF WIRING IN AN OFFICE BUILDING.

Methods of Construction in a Modern Type of Fireproof Building.

The building in which the electrical work here described is installed is a 12-story steel-frame structure covering a ground area of 36 feet 6 inches by 161 feet. The outer walls are of brick, and the floors are of wood laid on sleepers placed above arches of hollow tile which are built in between the steel I-beams that form the supporting frame of the floor. As is customary in buildings of this class, there is a layer of cinders between the wooden floor and the tile arches underneath it. The ceiling plaster of the various rooms is attached to the under surface of the tile formation, of course. Fig. 4 is a rough cross-sectional view of a small portion of a typical floor, at a ceiling outlet. Fig. 3 is a plan view which shows about two-thirds of a typical floor.

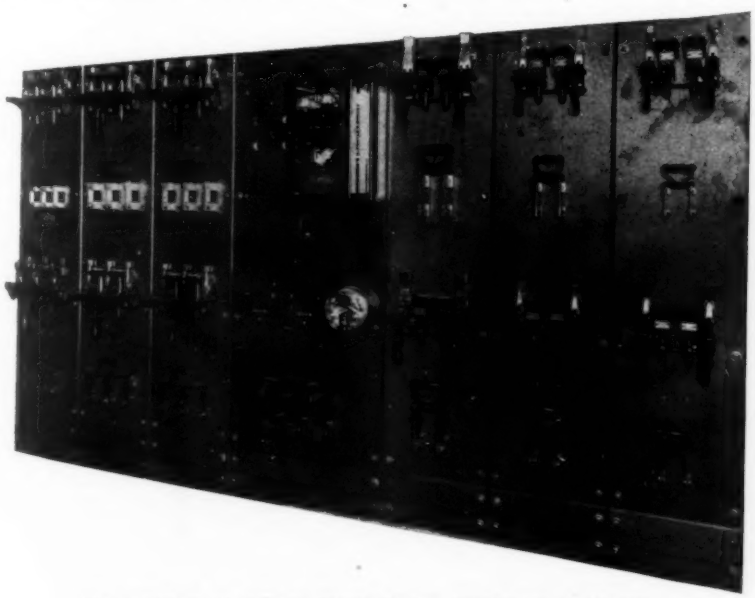


Fig. 1.—View of Service Board During Installation of Meters.

The building was erected by Crane & Company, the well known manufacturers of plumbers' supplies, etc., and is used exclusively by them for their Chicago offices. It fronts on Michigan Avenue, in what is perhaps the most fashionable shopping and office district of the city. The electrical work, which has just been completed, was done by A. S. Schulman, one of Chicago's leading electrical contractors, under the direction of Frank H. Getchell, electrical engineer for Holabird & Roche, of Chicago, the architects.

Electrical Equipment.

In any office-building the lighting is necessarily a rather large part of the total electrical load. If the installation is designed as it should be, however, with a view to securing the proper measure of modern conveniences, the motor load in any large building of this class is by no means inconsiderable. In the Crane building there are two house-pump motors of 10-horsepower capacity each; six fan motors varying in capacity from 7.5 horsepower to 0.25 horsepower; one 4-horsepower motor for operating an ice-making machine; a 1-horsepower motor which pumps water to drinking fountains located in various parts of the building; a 0.25-horsepower machine driving an air compressor; a 3-horsepower motor operating a bilge pump for delivering into the sewer all waste water from lavatories and the like located below the sewer level; a 2-horsepower vacuum-cleaner motor; two 30-horsepower elevator motors and a 3-horsepower unit for running an automatic dumb waiter; two motor-generator sets, of about 1 horsepower capacity each, one of which supplies low-pressure current for the elevator signals and the other that for the call-bell system; a 7.5-horsepower motor for running an ash elevator, and another of the same capacity for running a circulating pump; etc.

Perhaps it should be explained that four of the motors and some of the pumping units just referred to are parts of the ventilating system. Before it is admitted to the office rooms the air for ventilation is carried through a cleaning process which frees it from dust and other similar impurities. A description of the process, further than the explanation that electric-motor operation is employed, would be aside from the aims of this article.

The lighting on the first floor of the building is done by means of pendent fixtures of special design. Each fixture consists of an inverted bowl of translucent glassware suspended from the ceiling with ornamental chain supports. There are five 100-watt lamps in each bowl, and the bowls are placed approximately on 20-foot centers. On the floors above the first, single-lamp lighting units are employed, the lamp with its reflector being dropped from the ceiling on an ornamental chain. There is the same generous provision for quantity of light on the other floors as on the first.

The total lighting load is approximately 150 kilowatts. The motor load totals in the neighborhood of 150 horsepower.

Layout of Circuits.

Power is delivered to this office building, from the lines of the Commonwealth Edison Company, over a three-wire direct-current, underground distributing system. Three-wire mains are brought in to a service board located in the basement, from which point the lighting and power feeders are carried in conduits concealed in the basement floor to the bottom of what is termed the wire shaft, this being a shaft whose cross-section is two feet by five feet three inches and which extends vertically upward from

the basement to the top story. Up this shaft, which is located near the center of the north side of the building, and which is indicated with a cutout cabinet in it represented by means of a heavily shaded rectangle in Fig. 3, the conduit risers carrying the feeders up to the various floors are run. On every floor there is a distributing panel from which the two-wire branch lighting circuits radiate to the neighboring outlets, and these panels are all located one above the other in the wire shaft.

The motors are located in the basement and above the ceiling of the top story, in room provided for them there. The motor feeders to the machines in the top of the building are also carried up the shaft, along with the lighting feeders.

In Fig. 2 the location of the distributing panels is indicated rather clearly, as are also the number, sizes and arrangement of the feeders. It will be observed, too, that the number of branch circuits from each cutout cabinet is marked on the diagram. On the panel on the top floor, for example, there is room for 20 regular lighting circuits and two circuits for stairway lights; and similarly for the other cabinets, except that in the basement and the one on the first floor. Plug fuses are installed on these panel-boards for the protection of the branch circuits.

Lamp control is taken care of with push-button flush switches installed at points conveniently near the outlets to be controlled. A further reference to Fig. 3, with some explanation of the diagram, may prove helpful here. Consider the line of conduit extending to the left from the group of three switches marked *3s* near the upper right-hand corner of the figure. As wiremen familiar with standard working drawings know, the arrow which terminates the short line representing the conduit means that this pipe continues to the left to the cutout cabinet; and the other symbols show that this is a one-inch pipe containing six No. 12 wires; that the three circuits which these wires constitute are numbered 16, 17 and 18, respectively, at the distributing panel—where, by the way, every circuit is numbered; and that the three switches control the three outlets to the right of the point where they are located. Perhaps it is well to explain also, in passing, that the numerals within the circles representing outlets indicate the wattage to be installed there in terms of the 16-candlepower carbon-filament lamps. Thus, an outlet marked *10* is wired for 500 watts. Electricians not skilled in reading working drawings sometimes find it well worth while to make a close study of diagrams like this one; it is helpful practice.

General Notes on Construction.

It is hardly necessary to explain that the electric wiring in a building of the type under consideration is run in concealed iron conduits. Sherarduct conduit is used. All conduits are of standard gas-pipe sizes, and care was taken to cut all joints in pipes so that they would butt solidly into the couplings.

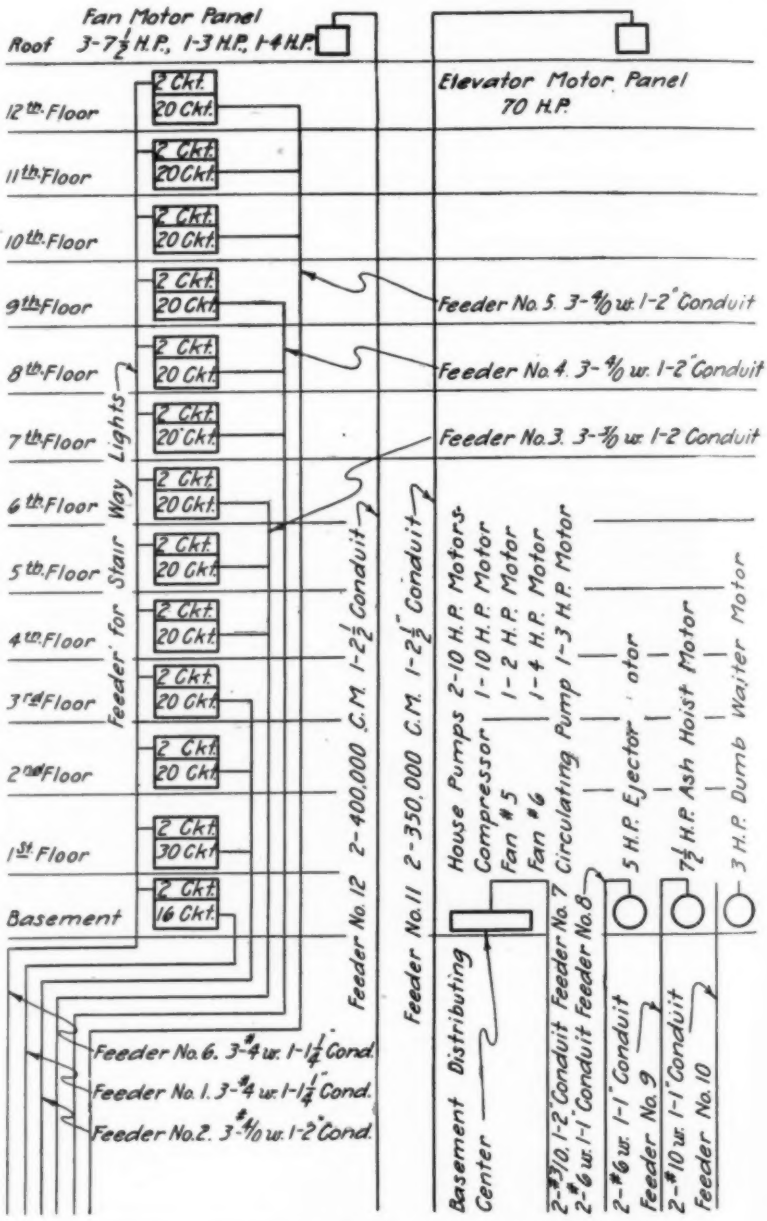

Fan Motor Panel
Roof 3-7½ H.P., 1-3 H.P., 1-4 H.P.
Elevator Motor Panel
70 H.P.
12th. Floor
11th. Floor
10th. Floor
9th. Floor
8th. Floor
7th. Floor
6th. Floor
5th. Floor
4th. Floor
3rd. Floor
2nd. Floor
1st. Floor
Basement
2 Ckt.
20 Ckt.
30 Ckt.
16 Ckt.
Feeder for Stair Way Lights
Feeder No. 12 2-400,000 C.M. 1-2½" Conduit
Feeder No. 11 2-350,000 C.M. 1-2½" Conduit
Feeder No. 5. 3-4/0 w. 1-2" Conduit
Feeder No. 4. 3-4/0 w. 1-2" Conduit
Feeder No. 3. 3-3/0 w. 1-2 Conduit
Feeder No. 6. 3-4 w. 1-1¼ Cond.
Feeder No. 1. 3-4 w. 1-1¼ Cond.
Feeder No. 2. 3-4/0 w. 1-2" Cond.
Basement Distributing Center
House Pumps 2-10 H.P. Motors
Compressor 1-10 H.P. Motor
Fan #5 1-2 H.P. Motor
Fan #6 1-4 H.P. Motor
Circulating Pump 1-3 H.P. Motor
5 H.P. Ejector Motor
7½ H.P. Ash Hoist Motor
3 H.P. Dumb Waiter Motor
2-3/0, 1-2" Conduit Feeder No. 7
2-#6 w. 1-1" Conduit Feeder No. 8
2-#6 w. 1-1" Conduit Feeder No. 9
2-#10 w. 1-1" Conduit Feeder No. 10

Fig. 2.—Arrangement of Feeders and Centers of Distribution.

Wherever running threads were necessary in a line of tubing, locknuts were provided on one side of the couplings. Special pains were taken to use only long bends in conduits, to keep the bends free from dents and bruises, and to make all joints watertight, white lead being employed at the joints. The best grade of wire was specified and used.

Each floor outlet box is watertight, and is provided with a receptacle, brass floor plate and nipple for leading out the wires, and with a cap for closing the opening when the outlet is not in use.

The busbars on all distributing panels are constructed of 98 per cent pure copper, milled or sawed into the proper shape. These are mounted on black Monson (Maine) slate panels one inch thick. The busbar connections were draw-filed, to insure perfect contact.

The cabinets which inclose the dis-

tributing panels, which will be described in detail later on, are made of No. 10 United States gauge sheet steel substantially reinforced.

nuts and with washers of the same material. Between the slate and the framework, fiber washers an eighth of an inch in thickness were inserted.

iron flush with the surface of the floor.

All switches, switch studs, etc., were designed for a maximum current density of 800 amperes to the square inch

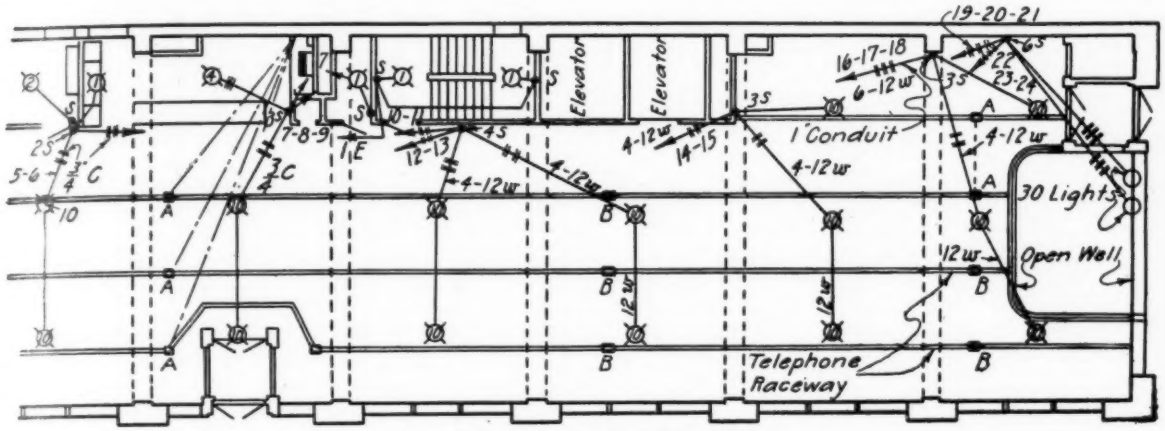


Fig. 3.—Part of Plan of First-Floor Wiring.

Outlet boxes of an approved type were provided at every outlet, of course, and ceiling outlets were hung by means of sherardized pipe-hangers of an approved type. Special pains were taken to remove only such knockouts in outlet boxes as were to be used for admitting the conduits and supporting pipes, and to set all boxes so that they would finish flush with the finished plaster line.

What has been referred to as the service board is built of black Monson slate one and a half inches in thickness, free from all metallic veins and flaws, and well oiled and rubbed to a

The switchboard frame was constructed of angle irons, the dimensions of these being three-eighths by one and a half by two and a half inches. Between the wall and the framework, behind the service board, there is a wall brace at the intersection of each panel. These braces consist of angle irons reinforced with fish plates. All busbar supports on the board are made of strap iron bent so as to insure a neat fit. The iron work was painted with two coats of black asphaltum paint, one of which was applied in the shops of the States Electric Company, of Chicago, which company built the

of cross-section. The studs were threaded, pinned and sweated into the fuse and switch bases. A smooth red fiber tubing, which fits closely, forms a covering for positive studs, while negative switch stuc are covered with black tubes of the same material, and the neutral ones with gray fiber tubes.

The busbars are made of laminated copper, and a clearance of at least one

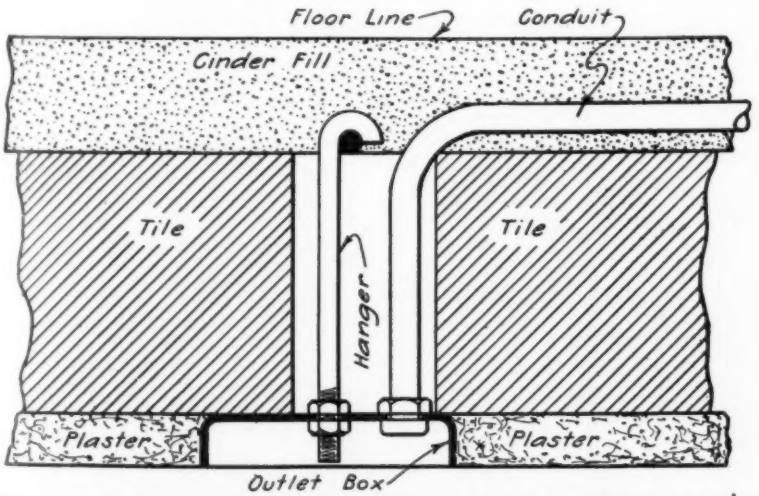


Fig. 4.—Section Through Floor Indicating Methods of Hanging Ceiling-Outlet Boxes.

Fig. 5.—Wiring Symbols.

smooth finish on both front and back surfaces. The slate was tested at an alternating pressure of 2,000 volts before it was put in service. The panels are fastened to the supporting framework by means of half-inch bolts, which are provided with acorn-headed copper

service board and distributing panels and cabinets, and the other after the frame had been erected.

Under the front panels of the service-board there is a continuous channel-iron footing, set so as to make the board perfectly level, and to make the

and a quarter inches is provided in all cases between bars of opposite polarity.

Fig. 1 is a photograph of the service board taken just before the installation of the meters had been completed. As will be noted, there is a service panel

in the center with feeder panels on either side of it, the power feeders being those with double-pole switches and the lighting feeders those having three-pole switches. Except on the service panel, automatic circuit-breakers are employed instead of fuses, and there are two breakers on each feeder panel for the reason that each panel controls two sets of feeders. For the upper row of switches there is a terminal board which is located at the bottom of the board on the back of the panels.

Connections between the feeder switches and the terminal board are made with copper busbars of ample proportions, and every set of feeders leaves the board at the bottom, where it enters the conduits through a condulet fitting. It is in order to note in this connection, also, that condulets are used at the motor end of all motor circuits, regardless of the size of the conduit, instead of the bushing-and-compound construction sometimes employed where condulets are brought out at the ends of large pipes.

Since the entire building under consideration is occupied by a single firm, all meters are installed on the service board.

Other Details of Installation.

In the first paragraph of this article there was a reference to the floor structure of the building, which was made with a view to calling attention later to the method of installing ceiling outlets and running conduits in the floors. Both of these processes are made so clear in Fig. 4 that but little more need be said on the subject. The ceiling-outlet box is supported by means of a hanger consisting of a piece of pipe threaded for lock-nuts at one end and bent around a short piece of pipe or rod at the other. This latter pipe or rod, which is heavily shaded in the figure, rests on top of the tile arch, which is thus made to take the weight of the outlet box and fixture.

What is marked "Floor Line" in the figure is approximately the level of the under surface of the floor. The conduits to the ceiling outlets are run beneath the floor, in a manner which is sufficiently evident.

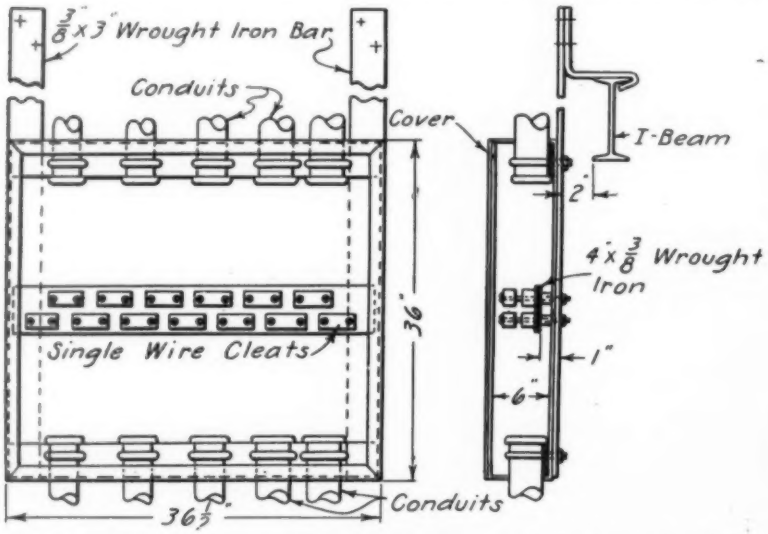


Fig. 6.—Front View of Frame for Supporting Feeders, with Cover Removed, and Sectional View with Cover in Place.

By referring to Figs. 7 and 8 one may get a good idea of the construction of the cutout panels and cabinets,

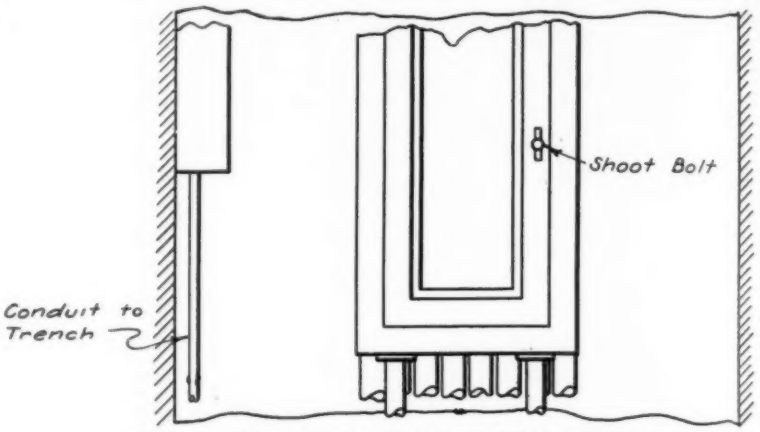


Fig. 7.—Front Elevation of Wire Shaft and Cutout Cabinet.

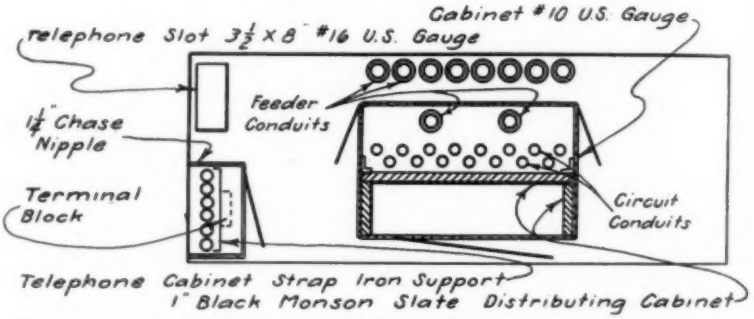

Cabinet #10 U.S. Gauge
Telephone Slot 3½ x 8 #16 U.S. Gauge
Feeder Conduits
1¼" Chase Nipple
Terminal Block
Circuit Conduits
Telephone Cabinet Strap Iron Support
1" Black Monson Slate Distributing Cabinet

Fig. 8.—Sectional View of Wire Shaft, Showing Cutout and Telephone Cabinets.

and also of the positions of these with reference to the conduit risers in the wire shaft. The pipes shown in section behind the cabinets contain feeders to panels on higher floors; the two larger pipes within the cabinet bring feeders to this particular center of distribution; while the smaller ones accommodate the branch circuits on this floor.

The cabinets containing the cutout panels have doors in each side to make the back of the panel board easily accessible to the man installing the wiring on them.

Providing proper support for heavy lighting or power feeders when they are run vertically upward for considerable distances very often proves to be a problem of no mean proportions. The fact is, the support is insufficient about as often as it is good, it seems. The contractor who put in the installation in the Crane Building overcomes this difficulty by using iron racks of substantial design, to which the conduits are fastened with U-bolts and the cables with heavy single-wire cleats, the rack itself being hung from an I-beam at the back of the wire shaft. Fig. 6 makes the construction of the rack rather clear, and also the method of attaching the circuits to be sup-

ported, although no attempt is made in the figure to show the cables in place. These racks are inclosed in sheet-steel boxes in the manner indicated in the sectional view.

In Fig. 8 the position of the telephone circuits in the wire shaft is shown. An article could be written on the bell and telephone installation alone in this building. This matter will not be gone into now, however, further than to call attention to the method of running the telephone circuits in the floors. Running lengthwise the building, there are parallel waterproof raceways in each floor for such wires. These are designated by the letters *A* and *B* in Fig. 3—at least, these letters indicate pockets and pull boxes, respectively, in the channels.

Conduits containing telephone wires run from the wire shaft to the pockets, *A*, and whenever a telephone is to be installed the circuit for it is pulled in from the nearest pocket by lifting the covers from as many pull boxes as is necessary and fishing the wires. The wires are brought through the floor by boring a hole into the trough or raceway and inserting a brass tube.

Association of Electrical Contractors of Chicago to Have Business Manager.

At a meeting of the Chicago Association of Electrical Contractors last week W. J. Collins was appointed Business Manager of the Association. Mr. Collins has been the secretary of the Faraday Electrical Association ever since that organization was formed, three years ago, devoting his entire time to this work. He will retain this position, and will be given sufficient additional office assistance to make it possible for him to look after the affairs of both associations.

W. J. Ball.

Electrical contractors who have followed the developments of the last two or three years in the contracting field know that in movements intended to promote the general progress of contracting as a business the state of Illinois is a leader. Among those who made it so, and who are keeping the state in front ranks is W. J. Ball, of Moline. During 13 years of continuous experience as the manager of a large construction business, Mr. Ball has been the closest sort of an observer of the problems the contractor has to deal with, and he has evolved ideas that are sound and safe to follow. Moreover, while he does not impress one as a man who ever has any special desire to impose his views upon anybody else when they have not been sought, he always manifests a most commendable disposition to help the other fellow whenever he can, although the other fellow may be a competitor of his. In fact, he says that he feels that anything that helps him is worth telling his competitors, and that it is by such co-operation as this that the contractor must hope to succeed.

Mr. Ball is 36 years old, and has been the secretary and manager of the Moline (Ill.) branch of the Tri-City Electric Company since about the time he reached his majority. He was born and brought up in Moline. His firm is a member of the National Electrical Contractors' Association and of the Electrical Contractors' Association of Illinois. He is himself the president of the Tri-City Electrical Employers' Association. He is a man of original ideas, and one who takes a lively interest always in the activi-

W. J. Ball, Manager Tri-City Electric Company.

ties of organizations of the kind just mentioned. Mr. Ball is an enthusiastic Jovian, his potential being 3956. He is a member of the Moline Club and of the East Moline Commercial Club. He is a man who makes friends readily, and whose general bearing is that of the unassuming but aggressive and successful business man.

Among the Contractors.

The W. H. Ochiltree Company, electrical contractors of Pittsburgh, Pa., has been awarded the contract for the complete electrical installation in the New Kensington High School, at New Kensington, Pa. This work, which is to be of highest class of construction, includes the wiring for light and power purposes and also that for the signal system.

The electrical wiring in the Holmes County court house, at Hillersburg, O., was recently entirely remodeled by the Wayne Electric Company, of Worcester, O. This building was first wired more than 25 years ago, and in the work of remodeling some very interesting old materials and fittings were discovered, including elaborate designs of wooden rosettes and cutout bases.

The Price Electric Construction Company, of New Castle, Pa., has the contract for the wiring and fixtures in the new building of the German Beneficial Union in New Castle.

The contract for the electrical fixtures in the new Masonic Temple in Rock Island, Ill., has been secured by the Electrical Construction and Machinery Company, of Rock Island. The price is $1,100.

The J. L. Thompson Electric Company, of Pittsburgh, Pa., has the contract for the electrical work to be installed in the new Basch office building in Pittsburgh.

The Wilson-Painter Electric Company, of Canton, O., has the contract for the wiring and other electrical work in the Catholic Club House, at Canton, and that in the Congress Lake Club House, at Congress Lake. Both of these installations will be high-class in every particular. In the illumination of the swimming pool in the Catholic club there will be some particularly novel effects, it is stated.

The Blumenthal-Kahn Electric Company, of Baltimore, Md., has been awarded the electrical installations in the round-house, engine terminals and power house of Cumberland, Md., for the Western Maryland Railway Company. The G. E. Painter Company were the consulting engineers. The amount of this contract is said to be about $13,500. The same firm has recently completed a contract of similar nature for the same company at Hagerstown, Md.

The contract for electric wiring for the Great Northern Railway Station at Minneapolis, Minn., has been awarded to the Minneapolis Electric Equipment Company, 227 South Fifth Street, Minneapolis, Minn. The contract covers the complete wiring system, in conduit, including remote-control switches and fixtures for the main depot and train sheds, and is said to be the largest wiring contract that has been awarded in the Twin Cities for some time. Thirty-per-cent Para-rubber wire is to be used throughout. This company, since the death of R. D. Thompson, has been under the management of A. W. Zahm, who was formerly located at Mason City, Ia.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, president, 59 Deerfield Street, Hartford, Conn.
H. S. WYNKOOP, vice-president, 13 Park Row, New York, N. Y.
WILLIAM LINCOLN SMITH, secretary and treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, 11 Wareham Street, Boston, Mass.
J. E. LATTA, assistant secretary, 605 South Dearborn Street, Chicago, Ill.

Executive Committee:

EUGENE N. DAVIS, chairman, Brookline, Mass.

Frank R. Daniel, R. P. Strong, Henry A. Knight, C. H. Fletcher
Washington Devereux, James B. McCarthy, James H. Fenton
R. J. Forsyth, C. W. Mitchell, A. W. Hopkins, G. W. Perry
George L. Collison, T. H. Fritts, A. H. Soper
T. W. Bowry, F. G. Hartwell, A. A. Moffitt, Thomas D. McColl

Secretary's Message.

The material appearing this number consists of the remaining answers to questions 226, 227 and 228, ten answers to which appeared on May 3. The Secretary regrets that they are not more replies, but seven members of the Committee have not sent in answers and he cannot hold the copy longer.

Bills for dues for the current year are now being sent out, and the Secretary requests a prompt response, as the funds are needed at once.

There are ten members in arrears for three years. Notices of this fact, with bills, were sent the middle of April to each of these gentlemen, but replies have been received from but two. The names of the others have been sent to the Executive Committee, and if they remain unheard from they will be dropped from the list.

The Secretary regrets that he can only send such a brief and mediocre message; it is due in part to a week of grippe which has interfered with work considerably. He promises to do better next time.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Bushings for Outlet-Box Covers.

Question 226. In installing cord pendants hung from outlet-box covers, should the bushing of the cover be of approved insulating material or of metal: (a) When ordinary flexible cord is used? (b) When reinforced cord, crefield or canvasite, or circuit wire is used?

Answer 11 (A). I should say insulating material in both cases.

Answer 12 (J). We require an insulating bushing in (*a*), the same as at the pendent socket (Rule 32*f*). It should be noted that this is essentially a different case from that of a fixture wired on the outside, where (Rule 26*x*) "conductors must be so secured as not to be cut or abraded by the motion of the fixture." In the absence of any specific Code requirements for insulating bushings where such external wiring enters the metal fittings, the practice is to accept a well reamed and rounded opening, without an insulating bushing, provided the conductors are secured as per Rule 26*x*.

We would make no distinction between cases (*a*) and (*b*).

Answer 13 (C). Yes; Rule 59*c*.

Answer 14 (Q). Insulating joint should be required where ordinary cord is used. I would not require insulating joint if tube and wire were equal to other part of circuit.

Answer 15 (D). With commercial flexible cord, bushings through outlet covers as well as insulating joints should be required. With reinforced portable cord, etc., bushings need not be required. See Rule 30*a*.

Answer 16 (*I*). Rule 59*c*, second paragraph, National Electrical Code, says that fittings designed for bringing conductors from metal conduits to exposed wiring must be provided with insulating bushings, "which, except with flexible cord, must separately insulate each conductor." If this rule contemplates any other fitting than outlet, junction and switch boxes, the heading is improperly worded. We take it that no other type of fitting is referred to in the rule, and we should insist that the paragraph just quoted from should govern in the construction with which this question is concerned. In other words, we should rule that, whatever the sort of wire employed for the pendant, an outlet-box cover *approved* for pendants must be used; and this, we believe, would result in a cover with an insulating bushing, for all of the approved covers for pendants that we know about have such bushings.

Answer 17 (N). I do not think that any rule in the Code covers this case in so many words, but at the same time the various sections having to do with outlet boxes, fixtures, conduit work, etc., enable one to reach a conclusion that appears logical and enforceable.

With ordinary flexible cord, unquestionably a single insulating bushing with cord attached within so no strain is on current-carrying parts is required. With canvasite, or heavy reinforced cord of other types is used I think a smooth rounded metallic opening like a pipe bushing was allowable, provided again no strain was placed on the current carrying contacts. With ordinary No. 14 line wire, I should say that each wire must be brought out through separately bushed insulating openings.

Answer 18 (M). Rule 59 requires insulating bushings.

Insulating Joints and Canopy Insulators in Canopies Having Pendant Lamps.

Question 227. Where a hickey is placed in an outlet box and carries a

short brass stem which, in connection with a canopy, forms an ornamental outlet for a cord pendant, may the insulating joint and canopy insulator be omitted: (a) Where an ordinary flexible cord is used? (b) Where reinforced cord, crefield or canvasite, or circuit wire is used?

Answer 11 (J). Undoubtedly the fixture socket, with its live working parts and its bare terminal wires, constitutes the principal source of trouble that necessitates an insulating joint and canopy insulator. The exposure arising in the canopy itself is much less serious, although it must not be lost sight of. We should construe this case as being exempted by Rule 30*a* from the insulating joint and canopy insulator requirement, as it fulfills the conditions imposed. The cord should be provided with an insulating bushing, as in the preceding question.

Answer 12 (A). If a straight electric box, the insulating joint could be omitted; if attached to gas pipe insulating joint would be required.

Answer 13 (Q). When installing ordinary cord pendant hung from a metal outlet-box cover, the cover should have at least one-thirty-second of an inch insulation between cord and metal. When reinforced cord or double-braided wire is used no insulation should be required, as the insulation of the pendant is equivalent to other part of circuit. When BX or Greenfield is used Rule 30 should apply. A new section under Rule 32 should be added, to cover this class of work.

Answer 14 (C). No. Part of this sort of equipment becomes a fixture installation and should be treated under Rule 30*a*.

Answer 15 (U). The canopy ring and insulating joint can be omitted if the canopy and stem are treated as a cover to the outlet box.

Answer 16 (D). Where commercial cord is used, approved bushings and insulating joints should be required. Where reinforced portable cord, etc., is used bushings need not be required. Rule 30*a* applies.

Answer 17 (R). Both cases are very clearly answered in Rule 30*a*, second sentence.

Answer 18 (M). If installed according to first six lines of Rule 30*a*, insulating joint is required in (*a*); third paragraph in same rule shows that canopy insulation is required.

As to (*b*), the last sentence of Rule 30*a* covers this point.

Poorly Installed Canopy at Door Casing.

Question 228. Sometimes a combination wall outlet is found to have been installed too close to a door or window opening, so that the fixture canopy is prevented by the door or window casing from fitting back closely to the wall, thus leaving a three-quarter-inch opening more than half way round the canopy. Is there any Code rule under which this condition can be handled?

Answer 11 (Q). This is not a matter for inspector to determine, as it does not affect the safety of the installation and is not covered by the rules. But some information could be gained by referring to General Suggestions in the Code. The inspector could recommend that the canopy be fitted to the wall for the sake of appearance.

Answer 12 (C). There is no specific rule on this particular point, but I would ask for a fiber or brass collar, as the casing or surface might require, under Rule 30*a*.

Answer 13 (A). I know of no rule in the Code to cover this case. If a regular fixture hanger was doing this work he would cut the canopy to fit.

Answer 14 (J). Code Rule 26*e* provides that wires, where exposed to mechanical injury, must be suitably protected. In the absence of any specific requirement under "Fixtures," we should apply Rule 26*e* to this case, and insist that the fixture-wire joints be completely inclosed and protected by the canopy inclosure.

Answer 15 (I). We would treat the canopy as an outlet box and apply Rule 59*c*. We would insist that the canopy be arranged to protect the wires completely. It might be necessary in some cases to cut away a portion of the door or window casing in order to install the fixture canopy properly. To leave the canopy open as described in the question would be the poorest sort of construction and should not be permitted at all.

Answer 16 (R). Under Rule 26*e* we should require that the fixture connections be fully inclosed by the canopy; but no rule in the Code would allow us to require any specific way of carrying this out.

Answer 17 (D). There is no specific rule in the Code requiring that canopies fit close to wall. It would be considered bad practice and poor workmanship.

Answer 18 (M). There is no Code rule exactly covering this point.

Discussion of Patent Law Changes.

Some of the salient features of the proposed Oldfield bill which is now pending in Congress, were commented upon by Lynn Williams, a patent attorney of Chicago, before the Electric Club of Chicago on May 8. In many points the bill in question provides for radical changes from present laws, and, while not thoroughly in accord with all of its provisions, Mr. Williams held that the present patent laws were in need of revision.

Two of the most far reaching changes relate to (1) resale prices; and (2) compulsory licenses. The Oldfield bill would prohibit manufacturers from compelling dealers to sell their product at a stipulated price, and would also prohibit manufacturers from enjoying a monopoly in the sale of supplies or repairs for licensed machines.

Other changes provide for the right of citizens or companies to demand the privilege of using patents that are withheld for three years or more; prohibition of the granting of exclusive agencies; and change in time that a patent is in force, the new law specifying that a patent right shall be granted for a period of 19 years, starting with the date on which the patent was applied for.

Mr. Williams thought that the new rules of practice would reduce the present high cost of patent litigation and tend in other ways to improve patent conditions.

Acting on Mr. Williams's suggestion, President Keech appointed a committee to investigate the new bill and suggest to the congressional committee such amendments or recommendations as may seem desirable.

Previous to the address on the patent situation, a motion was carried inviting the Jovian Lunch Club of Chicago to meet with the Electric Club at the regular meeting on May 22.

A. A. Gray made a preliminary report on the proposed by-laws revisions. The changes will be acted upon at a subsequent meeting.

Copper Exports.

Exports of copper for the week ended May 8 totaled 3,627 tons; since May 1, 10,000 tons; same period last year, 8,883 tons.

Thirty Years Ago.

Electrical News of 1883 as Presented in the "Electrical Review," the Pioneer Electrical Weekly of the United States—Ninth Installment.

(From "Electrical Review," New York, May 17, 1883.)

On June 13 the Association of Railroad Telegraph Superintendents meets at Chicago.

Holmes, Booth & Haydens are manufacturers of insulated electric light wire, from pure Lake Superior copper, conductivity guaranteed.

The very little heat that is given out by the electric light should make it a particularly desirable light for the warm weather, when coolness is such a desideratum.

The output of instruments by the Bell Telephone Company, which averaged 5,000 a month last year, has increased to 6,000 a month this year, and in April, the best month in the history of the corporation, it was nearly 7,000.

S. G. Lynch, of Chicago, well known in the telegraph and telephone field, has opened an office with Mr. Banta at that place for the purpose of dealing in telephone and electrical stocks. Their extensive and favorable acquaintance in the telephone field should assure them a large business.

The Bridgeport Brass Works are experimenting upon some valuable improvements in telephone wire and other electrical ideas. Under the able management of the genial F. W. Mason, the company has made rapid progress toward taking a leading position among the manufacturers who supply the telephone and electric light fields.

We are glad to learn that the young electrician, C. J. Kintner, late chief clerk in the Department of the Interior, has been promoted to the position of principal examiner in charge of the class of electricity in the Patent Office, lately made vacant by the resignation of Mr. Freeman. This is a deserved recognition of faithful service and ability.

The United States Electric Railway Company, of New York, which controls the combined patents of Thomas A. Edison and Stephen D. Field, is building an electric railway one-third mile in length running around the gallery of the Exposition Building. The road will be in operation during the National Exposition of Railway Appliances at Chicago.

The American Electric and Illuminating Company of Boston have just completed their contract for the first 100 lights ordered and have contracted for a plant of 100 more to be put in by the latter part of August or earlier if possible. It is only four weeks since the company put up their first light, and the extraordinary advance they have made has been in spite of the strongest opposition.

Among those who are giving intelligent thought to the electrical problems of the day is Lieut. Bradley A. Fiske, United States Navy. This officer contributes to the current number of *Van Nostrand's Engineering Magazine*, a paper upon "Electric Potential, Energy and Work," which is at once interesting and instructive. His suggestion that it is not well to have the same unit, the erg, for both energy and power, indicates, on his part, the possession of a clear, level-headed perception that older, if not more experienced, engineers than himself would do well to cultivate.

The certificate of incorporation of the Electric Railway Company of the United States was filed in the County Clerk's office on the seventh instant. The corporators of the new company are Grosvenor P. Lowrey, Sherburne B. Eaton, Robert M. Gallaway, Thomas A. Edison, Simeon G. Reed, Robert E. Deyo, Stephen D. Field, Charles W. Rogers, John P. Kennedy, and George S. Scott. Its capital stock is fixed at $2,000,000. The following officers were chosen: president, S. G. Reed, of Portland, Ore.; vice-president, C. W. Rogers; secretary and treasurer, Charles Dimon, and Stephen D. Field, electrician.

CHICAGO.—The Council's Fire-Alarm Committee and other officials of Philadelphia, with a number of gentlemen from New York, Cleveland, and other cities, recently witnessed an exhibition of the conduit system of underground telegraphy given by the Chicago Sectional Electric Underground Conduit Company. Morse and telephone wires were placed in one mile and a quarter of the conduit, and signals were exchanged over the telephone wires without any perceptible interference in the way of induction from the Morse currents. The conduits are built of iron and contain copper wire shelves, over which insulated conductors are drawn by means of carriers worked from manholes at each street crossing. The new harmonic system was also laid in the conduit and was in operation during the exhibition without causing any interruption.

The American Electric Company, of New Britain, Conn., has changed its name to the Thomson-Houston Electric Company. The new name brings the inventors of the lighting system owned by the company more prominently forward. This system of arc lighting makes high claims to public attention, as possessing many valuable features. The New Britain company lately passed into the control of capitalists near Boston who have changed its name as above, and have organized several subsidiary companies that are now using the Thomson dynamo machines and lamps with great satisfaction, especially in Boston, Lynn, Fall River, Hartford, Utica, Kansas City, Leavenworth, etc. The factory remains for the present at New Britain, but a large new factory is in progress at Lynn, which will be occupied by the company the present season.

According to a report read at a meetinb of the stockholders of the Edison Electric Light Company of Europe, Limited, there are in France 32 plants of the company with 2,680 lights; in Italy, 11 plants with 5,777 lights; in Germany, 28 plants with 3,667 lights; in Holland, 4 plants with 1,648 lights; in Austria, 7 plants with 1,724 lights; in Russia, 14 plants with 2,772 lights; and in Belgium, 12 plants, with 1,268 lights. A subordinate company has been formed in Germany, and the interests of the Edison and Siemens lights have been consolidated under the name of the Edison Electric Light Company of Germany. The capital of the company is 5,000,000 marks. The capital of the General European Sompany is $2,000,000. A company has just been formed to introduce central station lighting in Paris on a large scale, and a central station similar to the one in Pearl Street will be built.

By George LeCronier: "The suggestion of the editor of the *Scientific American* to the printer to wet the floor to overcome electricity is a good one, but it would be better to attach large wet sponges to the ceiling. The sponges will

be cheaper and more thorough than the brass bar and knobs which were recommended. The earth is not the grand reservoir of electricity, neither is it a conductor of electricity. The theory that electricity goes into the ground at Washington or Philadelphia and comes up under the Western Union Building is wrong. The explanation is that a wire grounded at both ends is tuned, which is not the case if it is not in the ground. There is no electricity in the earth for the reason that the earth holds moisture. Electricity, like a locomotive engine, must have a track to run on. All electricity and lightning is made at the moment and neither is stored or can be."

An irascible old gentleman on one occasion kept sending message after message to his daughter, until he had sent three. Each one required to be answered immediately, and each one failed to bring any response. Then he became wrathful, indignant, and finally abusive of all corporations. Shortly after he had left the office, the answer came which had been sent to him, and which informed him that all his telegrams had been received and that she had replied fully by mail—had sent two letters. The telephone, however, is going to correct all this. That is, perhaps, it is. The novelty, however, of answering on the telephone is gradually wearing off, and it may not be a great while before it will be as hard to get the person wanted to give a responsive ear to that instrument as it has been to get the sought-for replies by wire. "Can't raise them" is beginning to be heard with at least noticeable frequency on the telephone lines.

The people of Los Angeles, Cal., are highly gratified with the successful lighting of their city by Brush lamps on masts. A leading gentleman of the city recently sent a photograph of one of the masts to a friend in the East and wrote as follows regarding it: "This mast is 155 feet high with Brush arc lamps of 3,000 candlepower each. The city is at present lighted with seven masts of this description. One other mast has been ordered. The city has an area of thirty-six square miles. The masts vary in distance from each other from one-half to two miles. The city has been lighted with gas for sixteen years, although the area being in the most thickly built portion of the city was small and considered very inefficient. The present cost of illuminating the city is but a trifle more than that of the inefficient lighting by gas. All portions of the city now receive sufficient light for ordinary purposes on the darkest nights, and in the central portion of the city, where gas was formerly used, the light is far more effective than gas ever was. The public are almost unanimous in its praise. In a fog, when it is so dense that the lamps cannot be seen, the whole fog is suffused with the electric rays, rendering the streets perfectly light. It is now considered the finest lighted city on the Pacific Coast. With a view to more generally distributing the light, several more masts are about to be added."

By Edward H. Johnson: "In respect to the observations of Mr. Mackenzie as to the difficulties consequent upon a system of direct supply and of the utility of a method involving the intervention of some apparatus or storage device between the lamps and the generating source, I wish only to remark that Mr. Edison has fully overcome all the difficulties, as is proven by the fact that he is now supplying 400 customers from one station, the current ramifying through a network of over 24 miles of underground wires, and over 100 miles of house wires, without the loss of sufficient current on the whole system to keep alight a single lamp, and that this current has been maintained without a moment's interruption since the 4th day of September last, varying in quantity of course, directly proportioned to the number of lamps alight at one time; and, further, that since any other than a direct distribution means more or less loss or waste of energy, it follows that the direct system is the economical one, therefore the one best able to give cheap light. The important item of the cost of conductors involved in a system of direct supply has been solved in another way than that which Mr. Mackenzie's and similar devices provide—the problem of a reduction of their cost having been attacked and overcome without interference with the simplicity, reliability or energy and economy of the system."

Some Electrical Patents of Thirty Years Ago.

April 17, 1883:

Apparatus for covering telegraph cables, John Roberson, Brooklyn, N. Y.

Cylinder for rotary armatures, James F. Gilliland, Indianapolis, Ind.

Electric signaling apparatus for telephone lines, telephone transmitter, Daniel Drawbaugh, Eberly's Mills, Pa.

Incandescent electric light, Thomas L. Clingman, Asheville, N. C.

Secondary battery, Charles F. Brush, Cleveland, O.

Storage or secondary battery, Charles J. Van Depoele, Chicago, Ill.

(Quotations from* ELECTRICAL REVIEW *of May 24, 1883, will appear next week.)

Legal Notes

IMPROVEMENTS ON GOVERNMENT LAND.—Decision has been rendered in the United States Court at Salt Lake City, Utah, in the action brought by the United States Government against the Utah Light & Power Company. The Government contended that the company did not have the right to establish and maintain pipe lines, conduits, reservoirs, transmission lines, etc., upon the national forest reserves without first complying with the regulations of the Government. The company contended that it obtained its rights under a law enacted many years ago for the benefit of mining companies. The court held that the flume, reservoir, etc., had been established prior to the establishment of the forest reserve and that the company had a right to maintain them.

TELEGRAPH RIGHT OF WAY.—The contract between the Western Union Telegraph Company and the Louisville & Nashville Railroad, by virtue of which the telegraph company has maintained its lines along the right of way of the railroad, expired last August. The railroad company attempted to oust the telegraph company from its property but this was prevented by legal action. A suit to determine the compensation which should be paid by the telegraph company for the privilege of retaining its poles and wire line upon the right of way has finally been settled in the United States Circuit Court at Louisville, the jury returning a verdict for $500,000. This involves the use of a strip of land two feet wide for a distance of 1,400 miles.

The Supreme Court of Alabama, recently in session at Montgomery, upheld the right of the Western Union Telegraph Company to condemn a

right of way for its poles and wires over the right of way of the Louisville & Nashville Railroad Company, in that state. The decision constitutes a sweeping victory for the Western Union interests in Alabama covering as it does twenty cases of similar nature in county courts of the commonwealth. The only provision made by the Supreme Court in upholding the condemnation privilege was that the telegraph poles and wires shall not interfere materially with the operation of the railroad.

A petition for a new trial has been filed by the railroad attorneys, setting up the ground that the verdict is contrary to the evidence, and that the court's action in striking out incompetent evidence after its admission was not sufficient to counteract the prejudicial effect thereof. Most of the evidence stricken out in this way was that of President Milton H. Smith, of the Louisville & Nashville Railroad, who placed a valuation of several million dollars upon the railroad right of way occupied by the Western Union.

Metropolitan Telephone & Telegraph Decision.

The Appellate Division of the Supreme Court of New York has reversed a ruling of the lower court and has enjoined the use of the name Metropolitan Telephone & Telegraph Company by the Telepost interests. The suit was brought by the New York Telephone Company, which claimed that this name was used by a former company taken over by it, but some of whose bond obligations are still outstanding.

Public Service Commissions

MARYLAND.

The Public Service Commission has dismissed a complaint of the O. K. Manufacturing Company against the Consolidated Gas, Electric Light and Power Company. The opinion of the Commission deals in detail with the petition of the plaintiff, which sought to have the power company furnish it with alternating current, despite the fact that the factory is in the direct-current district.

NEW JERSEY.

The Legislature has passed and the Governor signed a bill providing an increase in the annual appropriation for the Board of Public Utility Commissioners from $100,000 to $200,000 and repealing a provision of the public utility act limiting the expenses to $100,000.

The Board has refused the application of the Farmers' Union Telephone Company, Sussex County, to increase its rates in accordance with a filed schedule, holding that such do not appear to be just and reasonable. The Board, however, is of the opinion that the present rates of the company are not sufficient to provide a proper allowance for depreciation and a reasonable return on the value of the company's property upon which such return can be fairly claimed, and accordingly recommends the filing of a new schedule by the company with the Board as follows: business, direct line, $24 per annum (present charge, $21); four-party line, $21 per annum (present rate, $18); residence, direct line, $21 per annum (present rate, $18); four-party line, $18 per annum (present rate $15). The increases desired by the company, and which the Board refused, were $27 per annum for direct business lines, $24 for party business service.

OHIO.

In deciding the case of the village of Milford against the Cincinnati, Milford & Loveland Traction Company, the Public Service Commission found that two of the residents of the village who had instituted the complaints were entitled to be supplied with electric current without paying for the installation of the necessary poles, wires, etc., to put them in connection with the distribution line. The company was already giving service in the neighborhood in question, but had refused to serve the complainants unless the latter paid for the extensions necessary to reach their premises. This refusal was decided to be unreasonable and unjust. The company was ordered to supply service by June 15.

OKLAHOMA.

The Corporation Commission has made final its order requiring all railroads, steam or electric, telephone and telegraph companies, gas and electric light, heat and power companies and all other public-service corporations coming under the jurisdiction of the Commission, to file with the Commission copies of all contracts, leases, agreements, or arrangements with other persons and companies affecting the carriage or transportation of persons or property or relating to the transmission of message or communications between points in the state of Oklahoma, or to the handling, use or rental of lines, equipment or facilities. When any contract is terminated or changed, the parties are required to notify the Commission in writing of such changes.

The Commission has made an order in the case of the Mary and Doby Springs Telephone Company against the Fort Supply Telephone Company, for physical connection, directing that the service be given.

Galletti Wireless System.

The Indo-European Telegraph Company of London—one of the most prosperous of British telegraph concerns—has paid $160,000 for the Galletti wireless telegraph and telephone patents. The technical details are not yet fully disclosed, but Galletti claims that the invention makes available a much larger proportion of the power used, both in the aerial at the transmitting end and at the receiving end, than is the case with any other system. Direct current is used, many experts holding that to be preferable to alternating. The Indo-European Company bought the system outright because the main patents are such as to give it a perfectly independent position among contemporary wireless systems. The directors are going to Switzerland immediately to witness demonstrations of telegraphy and telephony by the system over short distances to begin with, larger distances being taken as the experiments progress. There are two stations fully equipped, working in both directions, and messages are recorded by the Wheatstone automatic spstem. A transmitting station has been installed by Galletti's Wireless Company at Leschausc, some 60 miles distant from Geneva, but on French territory, from which Galletti expects to reach distant stations. Both the French and British Governments have given assistance.

COPPER.

Production and Price Statistics for the Period 1907-1912.

By John B. C. Kershaw.

The writer contributed to the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for April 30, 1910, an article on "Copper" which closed with the following paragraph:

"It is, of course, not wise to press the similarity in the form and period of the price curves too far, especially in the case of a metal which is subject to so much market manipulation, as copper. One may state, however, with some degree of confidence, that the conditions which affect the situation all point to a rise in the price of copper during the present year. The author therefore advises those who are likely to require large amounts of copper for fulfilling contracts and orders during the present year and early in 1911, to purchase for prompt and forward delivery at once, at the prices now ruling in the copper market, *and not to adopt a waiting policy.*"

That this forecast and advice was correct, was proved by the events of the past three years. After a delay of twelve months, a rise in values set in towards the end of the year 1911, reached its maximum point in September 1912, and although a decline in value set in after that date, copper is still well above the £60 limit, which may be regarded as the mean selling price of the metal, when the successive periods of boom and depression are averaged.

In the present article, the writer proposes to examine the figures for the total world's supplies of raw copper in the period 1907-1912, and the price variations for the past twelve years, and to once again attempt to forecast the probable course of prices, for the remainder of 1913, and for the following year. The figures used are taken from the statistical circulars issued monthly and annually by H. R. Merton & Company, of London, and are the most reliable data available.

I. Production Statistics.

The aggregate output of copper by all the producing countries of the world, had in 1912 reached the million-ton level, the exact figures being 1,-004,485 tons (of 2240 pounds) an increase of no less than 133,000 tons over the production of 1911.

TABLE I.—PRODUCTION OF COPPER BY ALL THE MINING COUNTRIES IN THE WORLD IN 1907-1912.

Year	Production in tons.	Increase in tons.	Percentage Increase.
1907	713,965		
1908	754,180	40,215	5.3
1909	839,425	85,245	10.1
1910	864,275	24,850	2.8
1911	871,920	7,645	.9
1912	1,000,485	132,565	13.2

*A decline of 235 tons was recorded in 1907.

TABLE II.—COPPER PRODUCTION OF THE TEN LEADING COUNTRIES IN PERIOD 1907-1912 IN TONS.

Country	1907	1908	1909	1910	1911	1912
United States	392,520	423,300	490,280	484,935	483,865	554,835
Mexico	56,565	39,990	56,325	61,515	60,905	70,845
Japan	48,935	43,000	47,000	46,000	55,000	65,500
Spain and Portugal	49,675	52,585	52,185	50,255	50,930	58,930
Australasia	41,250	39,500	34,400	40,315	41,840	47,020
Chili	26,685	38,315	35,785	35,235	29,595	37,305
Canada	25,615	28,570	24,105	25,715	24,930	34,710
Russia	15,000	20,085	17,750	22,310	25,310	33,010
Germany	20,490	20,200	22,255	24,710	22,010	23,920
Africa	6,800	6,880	14,945	15,205	16,980	16,370

TABLE III.—PRODUCTION OF COPPER MINES IN UNITED STATES IN PERIOD 1907-1912.

	1907	1908	1909	1910	1911	1912
Arizona	114,670	129,540	130,375	133,755	134,185	159,720
Montana	101,025	112,750	140,105	127,785	121,410	138,000
Calumet and Hecla	40,000	40,000	40,000	35,000	35,000	35,000
Other Lake Mines	58,355	59,225	61,450	63,840	61,615	68,405
Other States	78,470	81,785	118,350	124,555	131,655	153,710
Totals	392,520	423,300	*490,280	484,935	483,865	554,835

The totals for the past six years are given in Table I:

Ten years ago an output of one million tons of copper in one year would have been regarded as impossible, and this amazingly rapid increase in the production of the mines, and in the demand for copper, must certainly bring much nearer the time when the mines now being worked will be exhausted, and when new sources of the metal will have to be tapped.

Examining the production of the ten leading countries in detail, and placing them in the order of their present-day output, we have the figures given in Table II.

Comparing this table with Table II of the earlier article, we find that the various countries have practically kept the same relative positions, the only changes being that Japan has ousted Spain and Portugal from third place, and that Canada and Russia have also climbed up one step in the ranks of the producing countries. All ten countries have greatly increased their output of copper in the period 1907-1912, and between them they now supply 942,445 tons or 94 per cent of the world's total output of copper, as compared with 683,535 tons or 95 per cent in 1907. The position of the remaining eleven countries has slightly improved in the period under review, for these countries (between them) now produce 6 per cent of the total copper supply as compared with 5 per cent in 1907. The most noticeable feature in Table II is, however, the leading position taken by the United States, with an output of 554,835 tons of copper or 55.4 per cent of the world's total production of the metal. This compares with 392,520 tons in 1907, when the percentage worked out to 55.0. So far from losing its premier position, the United States is therefore increasing its hold upon the world's copper mining and smelting industry.

The production of the United States is distributed as shown in Table III, according to the latest figures of Merton & Company.

These detailed figures for the production of the American mines during the past five years are of special interest, when studied in the light of the price variations during the same period. In the years 1910 and 1911, it will be observed, when bar copper was selling under $300 per ton, the American copper financiers kept the output down by reducing the production from the Calumet and Helca and Montana mines, and by maintaining that of the Arizona mines stationary, whereas the independent producers in the outside states kept on increasing their output. In 1912, when this policy of diminished output had had its effect, and when stocks had been cleared off, and the price of bar copper had again soared, the Arizona and Montana mines and smelters were allowed to produce copper to their utmost capacity. An increase of 44,000 tons over 1911 is shown by the figures for the output of these two states alone, which produced in 1912, 297,720 tons of copper, or over one-fourth of the total world's tonnage of the red metal.

The position occupied by Mexico amongst the copper-producing countries of the world is also deserving of some comment. The output of the famous Boleo mine has kept fairly steady at between 10,000 and 13,000 tons per annum, whatever the fluctuations in the price of the metal, but the output for the other Mexican mines rises and falls in sympathy with the price movements of copper. In the years 1905, 1906 and 1907, when the price of copper was high, the outside Mexican mines produced between 45,000 and 34,000 tons per annum; in 1908, when the break in price occurred, only 27,590 tons were produced. The output during the past three years from these mines has risen from 48,-720 to 58,395 tons; this total will no

*In Table II of the article published in 1910, a printer's error has turned the production of the United States mines of 1909 into 590,000 tons; the correct figure was, of course, 490,000 tons.

TABLE IV.—COPPER PRODUCTION OF BRITISH COLONIES IN YEARS 1907-1912 IN TONS.

	1907	1908	1909	1910	1911	1912
Cape Copper Company	4,230	4,480	4,645	4,405	4,480	3,870
Namaqua Copper Company	2,500	2,400	2,300	2,500	2,500	2,500
Sundries	70		8,000	8,300	10,000	10,000
Australasia	41,250	39,500	34,400	40,315	41,840	47,020
Canada	25,615	28,570	24,105	25,715	24,930	34,710

doubt again fall when the inevitable break in price occurs.

The steady increase in the output of the African, Australian and Canadian mines is also noteworthy. In the year 1900 these outlying portions of the British Empire produced together only 38,000 tons of copper: while the output of 1912 aggregated 98,000 tons, nearly ten per cent of the world's production. The detailed figures for the past six years are given in Table IV.

There are many who believe that Africa will in time take the place of the United States in the copper production of the world; for there are known to be large deposits of copper ore in Rhodesia and in the territories north of the Zambesi, and if these can be worked at a moderate expense, great developments will follow in this part of the British Empire. The increase in the output of the outside African mines from 70 tons in 1907, to 10,000 tons in 1912, is therefore not without significance.

The copper output of Germany and of the mines of the Spanish Peninsula has been maintained fairly steady during the period under review, the management of these mines being conservative in character, and always having an eye to the maintenance of their ore reserves. Germany, which produced 20,490 tons in 1907, had an output of 23,920 tons in 1912, while the corresponding totals for Spain and Portugal were 49,675 tons and 58,930 tons, the latter being the highest production of copper yet recorded by the mines of the Peninsula. It is interesting to note that the three British colonies, Africa, Australasia and Canada, in 1912, had a higher aggregate copper output than these two old-established and historic centers of the copper-mining industry.

Price Variations.

The price of copper has undergone rapid changes during the period 1900-1912, and Table V gives the average price of bar copper on the first of each month, for the past 12 years.

A study of this table shows that there have been three periods of high prices within the period, with two intervening periods of depression, when the price of copper dropped below $300 per ton. The maximum attained was in February, 1907, when the metal attained the record price of $528 per ton, and as shown above, the average price for the whole of the two years 1906 and 1907, was well above the $400 per ton level. The present boom in prices, which commenced towards the end of 1911, has not carried the metal to such a high level as the preceding boom, and the highest price attained so far, has been $384.47 per ton, in September, 1912. In order to show the close relationship between these booms in price and the fluctuations in stocks, figures taken from H. R. Merton & Company's monthly circulars are given in Table VI.

TABLE V.—AVERAGE PRICE OF STANDARD BAR COPPER.

Year	Price	Year	Price
1901	$330.75	1907	$423.79
1902	256.33	1908	292.12
1903	281.85	1909	286.46
1904	285.83	1910	278.18
1905	336.41	1911	271.60
1906	419.78	1912	355.57

Taking the earlier figures given in this table, we see that the boom of 1907 was ended by the consumers restricting their use of copper until large stocks of the metal had accumulated in the refiners' and brokers' hands, the high-water mark as regards stocks being recorded in June, 1910, when 179,000 tons, or over two months' consumption of the metal, was lying in the refineries and warehouses, waiting for purchasers. The price at this time fell to $265.23 per ton, and remained in the neighborhood of this level until March, 1911, when a gradual unloading of stocks and improvement of price set in. This reduction of the stocks of copper was continued up to June, 1912, when the combined visible supply, including the stocks in Holland and Germany, was only 67,931 tons, or less than one month's consumption. The price of standard copper was then $377.78. From this date, the customary cycle of increasing stocks and falling prices has again set in, and although a slight check to this movement has been noticeable during the past two months, it may be doubted whether it is more than temporary in character. With a slackening-off in the general trade boom, there is bound to come a reduced demand for copper. Adding to this the deterrent effect upon buyers of what must still be regarded as a high level of prices, one obtains the conditions which have always brought about in the past a fall in the selling price of copper.

TABLE VI.—THE RELATIONSHIP BETWEEN PRICES AND STOCKS OF COPPER.

Quarter Ending	Total Stocks in America and Europe Excluding Holland and Germany	Including Holland and Germany	Price of Standard Bar Copper
December 31, 1908	110,667	.....	$310.25
December 31, 1909	172,310	.....	300.51
June 30, 1910	179,129	.....	265.23
December 31, 1910	138,275	160,075	262.19
March 31, 1911	154,592	171,892	265.23
June 30, 1911	140,455	157,755	277.40
September 30, 1911	130,239	148,589	267.67
December 31, 1911	97,218	110,618	305.38
March 31, 1912	75,018	88,918	333.37
June 30, 1912	61,386	67,931	377.78
September 30, 1912	72,363	76,100	384.47
December 31, 1912	87,373	90,225	372.91
March 31, 1913	78,811	91,624	330.33

In concluding this discussion of the relation between the stocks and price of copper it may be pointed out, that a fall of $50 per ton in the selling price of the metal upon the present scale of production and consumption, means $50,000,000 saved to the consumer, and that a rise of $50 per ton, on the other hand, indicates that the profits of the mining and smelting companies will be increased by a like amount. One can understand therefore the great industrial and financial interests at stake in the fluctuations that occur in the market price of the metal, and can realize that it is not very surprising if the American producers, who still control 54 per cent. of the world's output of copper, use their power at the psychological moment to inflate prices and increase their own profits. But, as shown by the figures given in the course of this and the preceding articles, these attempts never lead to any permanent rise in the price; the higher level of values restricts consumption, stocks accumulate, and prices fall; and a period of depressed prices intervenes before the same cycle of operations is repeated, with the same effects. The boom years of 1899-1900, and of 1906-1907, in the copper industry, were followed by the slump years of 1901-1902 and of 1908-1909, and in each case the duration of the period of low prices exceeded that of the high. A study of the price curves for the past ten years, therefore, seems to indicate that the present boom has run its course, and that a period of slackened demand and diminishing prices is ahead of those interested either as producers or consumers in the copper market.

Summary and Conclusions.

(1) The world's output and consumption of copper has now reached the million-ton level, and new sources of supply will soon have to be tapped, if it is to be maintained at this enormous figure.

(2) The copper mines of the United States still supply 54 per cent of the aggregate output of the metal. The

predominating position occupied by the states of Arizona and Montana in this production of copper renders it comparatively easy for the American copper financiers to control the surplus stocks, and therefore the price of the metal.

(3) The British Colonies, Australasia, Canada and Africa, are rapidly increasing their output, and already produce 10 per cent of the world's supplies of copper. The copper-ore deposits of Africa, in Rhodesia and also north of the Zambezi, are known to be extensive. If this ore can be smelted at reasonable cost, and the resulting metal transhipped to the coast and to Europe at moderate freight charges, America in time may lose its dominating position in the world's copper mining industry. The output of 10,000 tons of copper in 1912 by the African mines situated outside of the Cape mining area, is therefore of considerable significance, in its relation to the future of the industry in that country.

(4) The price of copper is subject to periods of boom and depression, which are found to be, in their turn, dependent upon the relation between supplies and demand. When trade is good, the demand for copper increases; activity in the electrical engineering and shipbuilding industries especially, creating a great demand for the red metal. The varying level of the stocks stored in the refineries and in the metal brokers' warehouses, is the best guide to the relationship between supply and demand, and therefore to the price of copper. A study of the stock and price variations during the past three years, brings out this feature of the copper market clearly.

(5) At the present moment the tendency is for stocks to increase, and for the price to fall, and the writer of this article is of opinion that this tendency will become more pronounced, as the year advances. Consumers of copper generally, and the electrical engineering industry in particular, would therefore be wise to adopt a hand-to-mouth policy in their purchases of this metal, and to keep their stocks of copper at the lowest possible limit consistent with the requirements of their business.

British Report on Wireless.

The technical committee appointed by the Postmaster General of Great Britain to report on systems of long-distance radiotelegraphy, with respect to the proposed imperial chain of wireless stations, has made its report, which states: "The Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the imperial chain, but this must not be taken to imply that, in our opinion, the Marconi Company must necessarily be employed as contractors for all the work required for the imperial chain. Indeed, in some respects it might, we think, be better for the Government to undertake the construction and equipment of the necessary stations."

The committee considers wireless telegraphy to be in a condition of rapid development and thinks it undesirable that the Post Office should be pledged to the continued use of any existing apparatus, or subject to any penalty by way of continued royalties. With a trained staff and with an engineer of special knowledge and standing at the head for testing, and, if necessary, further developing any new invention or improvement, the committee sees "no reason why the Post Office wireless stations should not be ultimately equipped with apparatus far more efficient than that now used in any so-called system, more especially as the Post Office will be able to combine, in spite of existing patent rights, apparatus or devices which, because of the existence of such rights, cannot now be combined by any one else."

The committee also investigated the following wireless systems: Telefunken, Poulsen, Goldschmidt, and Gallette.

One of the Post Office requirements is for continuous communication by day and night over land and water for distances ranging from 2,000 to 2,500 miles. The companies controlling the various systems were invited to give practical demonstrations. The report says:

"Except in the case of the Marconi system we did not obtain any demonstration on a commercial scale, or any demonstration over a distance of even 1,000 miles."

But the committee points out the fact that it was apparently impossible for some companies to arrange a demonstration within the three months allowed for the purpose.

The Committee consisted of William Duddell, president of the Institution of Electrical Engineers; R. T. Glazebrook, director of the National Physical Laboratory; Alexander Kennedy, James Swinburne, E. H. Rayner, and Lord Parker, chairman.

Aluminum Cables in Paris.

The Paris Omnibus Company has placed a contract for armored aluminum cables for railway feeder networks, comprising 300 tons of metal. These cables are intended for operation at 500 volts and are expected to show an economy of eight to ten per cent as compared with copper.

Illumination at the Panama Exposition.

Marvelous advances in illuminating materials and methods will enable San Francisco to illuminate the buildings of the Panama Exposition, inside and out, in a way that would have been physically impossible five or six years ago. The skilled illuminating engineer is today enabled to produce light effects undreamed of at any of the former world's expositions.

The entire plan of the illumination is in charge of W. D'A. Ryan, director of illumination, who is also directing the illumination of the San Diego Exposition and the Panama canal throughout its length. More than $50,000 have been expended in a single line of experimentation—the development of cut-glass reflectors to be known as "jewels," for use at the exposition. Most of these have been made in Germany and the results produced through their reflected light will be among the superb lighting effects.

The most striking phase of the illumination plan lies in the fact that there will be no dark shadows. At night the exposition palaces with the details of their facades and statuary will be seen clearly. Great paintings upon the walls, screened by the colonnades of the courts, will appear in their true color values. In the harbor before the grounds, batteries of colored searchlights will throw beams against the towers and minarets, and against the reflecting jewels.

Both direct and indirect lighting will be employed at the exposition. Mr. Ryan is working in accord with Jules Guerin, director of color. Mr. Guerin has conceived a marvelous color scheme in which there will be no dead white upon the exposition grounds. Mr. Ryan has planned that there will be no glare and no dark places or black shadows at night.

Outline lighting will not be adopted. Although the contours of the buildings are brought out by this method, much of the architecture and most of the finer details would be lost through dark shadows. The architectural splendors of the exposition will be brought out to the best possible advantage in both form and color. By night the exposition in all its details will be a magnificent picture. All Guerin's colors, the burnt orange, vermilion, cerulean blue and gold of the courts, the gold and blue of the recesses of the towers, the vast friezes of red, yellow and blue, the red tiles of the roofs, the golden domes and the copper-green minarets will be seen at night.

The Exposition grounds contain 625 acres in the Harbor View section, forming a natural amphitheater over-

looking San Francisco Bay and the Golden Gate entrance from the Pacific. They include part of the United States military reservation, the Presidio on one end and Fort Mason on the other. The grounds are within the city limits of San Francisco, less than two miles from the heart of the business section. extend over two miles along the water front and average one-half mile wide.

In composition the architectural plan consists of three principal elements, that of the center being the main group of exhibit palaces and the other two elements balancing on either side. To the east are the amusement concessions, while to the west lies the small city of foreign government pavilions and state buildings. The main exhibition palaces occupy over 100 acres. They are flanked by tropical gardens on the north and south sides, containing about 100 acres, in which the Festival Hall and the Horticultural Building will set.

The majority of the main palaces are architecturally united into one enormous structure, equal in height to the average six-story city building. The palaces of Education, Fine Arts, Administration, Varied Industries, Manufacture, Liberal Arts, Machinery, Mining, Transportation and Agriculture are approached consecutively like the rooms of a single colossal palace, and identified chiefly by their interior equipment.

The central block is divided by three magnificent courts developed longitudinally north and south, called the Festival Court, or Court of Abundance, the Grand Court of Honor, or the Court of the Sun and Stars, and the Court of the Four Seasons. They are interconnected from east to west and open in each case to the Esplanade and water front. The Grand Court of Honor in the center is the largest, approximating 500 feet by 900 feet, and is dominated by the great tower on the south side, which rises 400 feet into the air on the Administration Building and over the main entrance. Each of the two lateral courts cover approximately 300 square feet.

The Court of the Sun and Stars will stand out among the most brilliant architectural expressions of the world's great expositions. It will be distinguished not alone by the majestic scale of its architecture, but by the splendor of its conception and the warmth of its color effects. The tower at the southern entrance will be studded with 50,000 jewels, diamonds, topazes, rubies and sapphires, which will sparkle at night in powerful rays from batteries of searchlights.

The center of the Court will be graced with a great sunken garden, five feet below the court level, rich with palms and shrubs and flowers. Two great fountains embracing groups of statuary, one signifying the spirit of the East and the other the spirit of the West, brought together through the Panama Canal, will also lie on the main axis within the Court. At night the Court will be illuminated from these fountains. They will be constructed of dense white glass, and in the daytime will in no wise suggest light sources. Within each fountain will be concealed 72 luminous arc lamps, a total of 144 lamps for the Court. At night, when lighted, the entire surface of the fountain will become luminous, flooding the Court with diffused white light.

There will be four principal sources of light at the exposition. In the harbor some 600 yards off the exposition grounds will be great batteries of searchlights mounted upon pontoons; masked batteries of searchlights will be located upon the roofs of the exhibit palaces; behind the columns of the colonnades that encircle the courts and in recesses of towers, domes and minarets indirect lighting will be employed. The interior of the buildings will be lighted with flame arcs and luminous arcs.

The walls behind the colonnades in the grand court of honor, the Court of Sun and Stars, and in the great east and west courts, will be decorated with mural paintings which will be illuminated by electric lamps placed in recesses in the backs of the columns, the lamps will not be visible from the floors of the colonnades or from the courts. They will be set in the columns at heights of 10, 20 and 30 feet. The illumination of the paintings will be controlled by changing the size of the units and the curvature of the mirrors that will reflect the light against the walls. Kaleidoscopic effects will be obtained by introducing colored bulbs. A special type of tubular lamp has been developed for fluted columns, the lamp and reflector being small enough to go into a flute of each column.

The method of turning on the light at night will be original. At first the visitor will notice myriads of little jets of light throughout the exposition where batteries of searchlights throw their rays against the jewels in the towers and above the figures of the stars around the Court of Sun and Stars; then from behind the columns of the colonnades that line the walls of the buildings the light will break out, flooding the mural decorations with radiance; then will come the great white light throughout the exposition, and finally scintillators anchored 600 yards off the esplanade will direct their batteries of colored lights throughout the exposition grounds. These scintillators will be manned by 50 and 60 men who are drilled to handle the batteries of lights in much the same manner that artillerymen are drilled. "The effect," says Mr. Ryan, "will be marvelous. The batteries will go through evolutions of color, forming auroras in the sky and over the exposition, that will spread like a great lily. On clear nights the shafts of light will be visible 40 or 50 miles."

Throughout the grounds ornamental luminous arcs will be used and fitted with dense globes, which will reduce the intrinsic brilliancy of the lamp to a point where it may be looked at directly without injury to the eye. The inclosed flame-arc lamp is well suited for lighting large inside areas and will be used extensively for indoor lighting.

There will be electric fountains, but no water will flash in them. Instead, smoke and steam, much superior media for such effects, will be sent into the air and glow with tints from the rays of the mighty scintillator. Contrasting delicately with these geysers of color, thousands of gigantic soap-bubbles will be released from a large blower and float into the air. On these the powerful rays of the scintillator will glisten with the iridescence of an insect's wings.

Commonwealth Edison Circus.

Employees of the Commonwealth Edison Company, under the auspices of the N. E. L. A. section, held a monster circus and entertainment on Saturday evening, May 10, that overshadows anything in the way of entertainment ever before attempted by the Chicago organization. The new Medinah Temple, which has the largest seating capacity of any hall in the city, was filled to its capacity. All the thrills and stunts found in the professional circus were in evidence and much credit and praise is due to those taking part.

Southern Aluminum Project.

Work has been started by the Hardaway Contracting Company upon the new hydroelectric plant of the Southern Aluminum Company at Whitney, N. C. A dam will be built on the Yadkin River 200 feet high. The height of water thus made available will be 177 feet, which will serve to generate 220,000 horsepower. It is expected that this will all be used for the manufacture of aluminum. The Southern Aluminum Company is an $8,000,000 corporation controlled by French capitalists. It took this development over from the North Carolina Electrical and Power Company, a New York concern.

Meeting of Board of Directors of Society for Electrical Development.

The Board of Directors of the Society for Electrical Development, Incorporated, held a meeting in New York City on May 13. A financial statement was presented which showed that over $100,000 had already been pledged for carrying out the work of the Society, and the funds already in hand are sufficient to provide for publishing a booklet with complete plans of the contemplated work, and for printing the by-laws. It is estimated that $200,000 will be required to carry out the plans. Stephen L. Coles was engaged as general publicity agent and the Frank Presbrey Company, of New York City, was selected as the advertising agency to handle the Society's general advertising.

The Committee on Design and Slogan made its report. The total number of designs and slogans submitted by the various contestants for the prizes which were offered by the Society amounted to 2,675. The Committee recommended the adoption of the slogan "Do It Electrically." The Board approved this recommendation and the prize was awarded to the five contestants who submitted this same proposal. They are J. A. Burke, of the United Electric Light & Power Company, New York City; E. B. Featherstone, Pacific Gas & Electric Company, San Jose, Cal.; Max Lowenthal, of New York City; C. B. Briggers, of St. Louis, Mo.; and K. Tornberg, of Lynn, Mass. The prize of $100 for the most suitable trademark was awarded to the design submitted by Philip S. Dodd, the secretary of the Society. Mr. Dodd was unwilling to accept this prize on account of his connection with the Society, and it was added to the amount to be distributed to the winning slogan contestants.

A special committee was appointed to prepare an amendment to the constitution covering the classification of members.

Charles E. Brown, of the Central Electric Company, Chicago, Ill., was elected a director of the Society in place of R. V. Scudder, deceased, and John R. Galloway, Washington, D. C., was elected director to succeed P. M. Thorpe.

The annual meeting of the Society will be held at the Hotel Sherman, Chicago, Ill., on May 31, the meeting to convene at 11:30 a. m. The Board of Directors put through a large amount of preparatory and detail work in readiness for this meeting and a general plan for prosecuting the plan of the Society was adopted. This work will proceed actively when the amount of subscriptions has reached $200,000.

A Nominating Committee was appointed to recommend officers and directors for the ensuing year. It will report at the annual meeting in Chicago.

Annual Meeting of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineering Societies Building, New York City, on Tuesday, May 20, at 8:15 p. m. At this meeting the report of the Board of Directors for the fiscal year ending April 30 will be presented, and the result of the election of officers for the next year will be announced.

The technical session will be under the auspices of the Railway Committee, and the following papers will be presented: "2,400-Volt Railway Electrification," by H. M. Hobart, and "Trunk-Line Electrification," by Charles P. Kahler.

The meeting will conclude with the usual smoker in the Institute rooms, where light refreshments will be served.

Meeting of Radio Engineers.

At the meeting of the Institute of Radio Engineers, on May 8, A. E. Kennelly delivered an exceptionally interesting paper on the "Daylight Effect in Radiotelegraphy," covering the general theory of radio transmission between earthed conductors, and the probable causes of attenuation and of the rapid variations in signal intensity which occur near times of sunrise and sunset. The meeting was very well attended, and a discussion, in which representatives of nearly all radio and wire communication interests took part, followed the address.

The next meeting will be held at Fayerweather Hall, Columbia University, 8:15 p. m., Wednesday, June 4. John L. Hogan, Jr., of the National Electric Signaling Company, will present a paper describing the new "Heterodyne" receiver as used in the Fessenden system during the recent trials of the Arlington Naval radio station.

Temperature Coefficient of Graphite.

The temperature coefficient of electrical resistance of ordinary carbon is well known to be negative, that is to say, the resistance decreases as the temperature increases. In the case of graphite this relation does not hold, and in some experiments described by Edwin F. Northrup in *Metallurgical and Chemical Engineering* it was found that the resistance of some graphite electrodes remained practically constant up to a temperature of 1,500 degrees centigrade. These electrodes were made of Acheson graphite of the best quality.

There is said to be on exhibit in France a dynamo only six millimeters high and weighing 0.2 ounce.

Mica.

The total value of mica produced in the United States in 1912, was $331,896, a decrease of $23,908, compared with 1911. The production came from eight states—North Carolina, New Hampshire, Idaho, New Mexico, South Carolina, Colorado, South Dakota, and New York, named in the order of the value of their output. The production of sheet mica amounted to 845,483 pounds, valued at $282,823, compared with 1,887,201 pounds, valued at $310,254, in 1911. The total output of rough-trimmed sheet mica amounted to over 2,000,000 pounds in 1912.

The mica mines of the United States are capable of a large annual production and could be made to supply all but the small part of the demand which calls for the softer Canadian amber mica. This could be accomplished if some of the largest already proved mines in North Carolina, New Hampshire, South Dakota, Idaho, New Mexico, Virginia, and Colorado were operated on a large scale or even as they have been worked in the past. Other deposits in these and many other states could be developed to meet increasing future demands.

Cost of Production Abroad is Less.

The cost of producing mica in the United States is considerably greater than in some other countries, especially India, and it is probable that this difference in cost could be lessened by more extensive operation of the larger and better deposits with improved methods. In size and quantity the mica obtained from the large mines generally averages better than that from many small deposits.

The imports of unmanufactured and trimmed sheet mica into the United States during 1912, as reported by the Bureau of Foreign and Domestic Commerce amounted to 1,989,132 pounds, valued at $748,973, exceeding those of 1911 by 660,364 pounds in quantity and $246,810 in value.

Expansion of Automatic Telephony in Australia.

In 1912 the first automatic telephone switchboard was installed in Australia, the work being carried out under the supervision of a representative of an American firm, to whom is due the credit for the introduction of the system to the commonwealth. Gellong, in Victoria, was selected by the authorities for the initial experiment. As a result of the satisfactory working of that exchange, 20 suburban exchanges near Sydney are to be similarly equipped and there is every probability that before 1913 has closed still further expansions of the automatic service will be inaugurated.

A STROBOSCOPIC FREQUENCY-METER.

By C. F. Lorenz.[1]

In a recent article[2] the writer called attention to the sharpness of the stroboscopic effects which may be obtained with suitably arranged incandescent filaments, and it was suggested that such sources might be found useful in numerous cases in which it is desirable to illuminate anything intermittently, or according to any particular mode of rapidly changing intensity. An application that suggests itself immediately is the measurement of alternating-current frequency. Stroboscopic methods of measuring frequency and speeds of rotation possess certain advantages, and doubtless the reason they have not been more generally used has lain in the lack of a convenient and reliable source of light.

Mode of Variation of the Light from a Rapidly Cooled Wire When Traversed by Alternating Current.

The fortunate circumstance that the light emitted by an incandescent solid varies much more rapidly than its temperature makes it possible to use simply a thin gas-immersed filament connected to an alternating-current circuit to measure stroboscopically the frequency of the latter without resorting to any auxiliary device for increasing the abruptness of the illuminations. This point is illustrated by the diagram, Fig. 1.

A is the sinusoidal impressed electromotive force wave, and if for simplicity we assume zero temperature-coefficient of resistance for the wire, the current wave will be undistorted, and in phase with the electromotive force, so that the rate at which electrical energy is dissipated in the circuit will be represented by the sine-squared wave *B*. If the filament had an infinitesimal thermal capacity, then the temperature of the wire would at any instant be determined by the condition that the heat generated equals the heat lost, that is,

$$EI \sin^2 pt = f(T)$$

where $f(T)$ would in general be a function of the temperature, depending both upon radiation and conduction-convection losses. Immersing a thin filament in a gas tends to make the effect of the thermal capacity negligible on account of the great loss of heat through the gas. Furthermore, since for a thin filament the conduction-convection loss is much greater than the radiation loss, and since the former is approximately proportional to the difference of temperature of the wire and its surroundings, we have for this case that $\sin^2 pt$ and the temperature of the wire are approximately proportional to each other, if we take the surroundings to be at zero temperature. The curve *B* may then be taken also to represent the temperature of the wire.

To illustrate the nature of the resulting candlepower variations, it will suffice to plot a curve showing the relative instantaneous values of the intensity of the light emitted as radiation of some one wave-length, say 0.58 microns, which lies in the yellow of the spectrum. For this particular wave-length Wien's law

$$J = \frac{c_1}{\lambda^5} e^{-\frac{c_2}{\lambda T}}$$

where $c_2 = 14{,}500$ becomes

$$J = Ae^{-B/T}$$

Where *A* is a proportionality factor and *B* has the value 25,000.

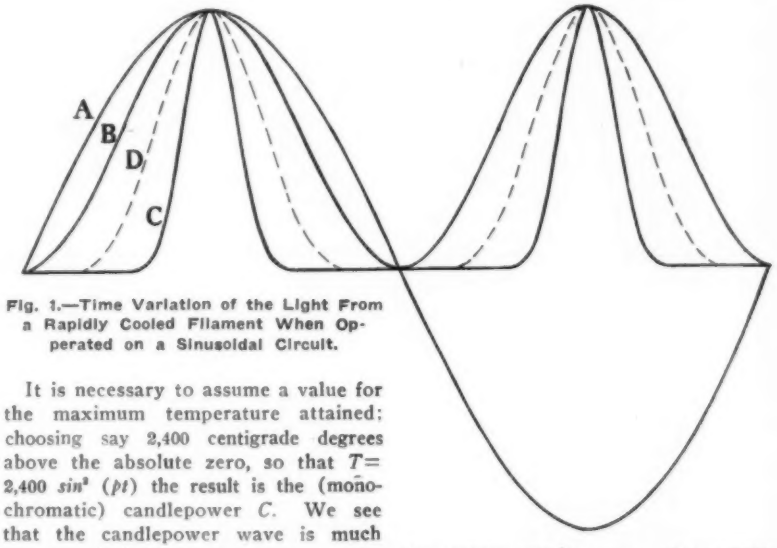


Fig. 1.—Time Variation of the Light From a Rapidly Cooled Filament When Operated on a Sinusoidal Circuit.

It is necessary to assume a value for the maximum temperature attained; choosing say 2,400 centigrade degrees above the absolute zero, so that $T = 2{,}400 \sin^2 (pt)$ the result is the (monochromatic) candlepower *C*. We see that the candlepower wave is much more peaked than the energy wave, and that the candlepower is practically zero for a large part of the period; a gas-cooled filament is thus capable of giving stroboscopic effects of considerable sharpness even when operated on alternating current.

It may be of interest to plot a corresponding curve for the case of a thin filament operated in a vacuum. Assuming black-body radiation, we now have the heat emitted by the wire at a rate proportional to the fourth power of the temperature, and assuming the heat capacity negligible, so that heat generated and emitted can be equated, we have

$$T = 2{,}500 \ (\sin pt)^{\frac{1}{2}}$$

Calculating instantaneous candlepower as before, we get the dotted curve *D* which is considerably less peaked than *C*. We can thus not expect such sharp stroboscopic effects from a vacuum lamp operated on a sinusoidal current as from a gas-filled lamp, even if its filament is excessively thin. With higher assumed maximum temperature the discrepancy between the two types of lamp becomes greater. The main advantage of the gas-immersed filament, however, lies in the fact that the great cooling action of the gas makes the heat capacity of the filament practically negligible even though the latter is not excessively thin.

Elements of a Stroboscopic Frequency-Meter.

The stroboscopic measurement of frequency requires the combination of an intermittent illumination with a suitable moving screen. The latter may take the form of a rotating drum or disk on an endless belt provided with suitably spaced dots or other marks. We may choose either to have the screen moving at a rate proportional to the frequency to be measured and the rate of illumination strictly constant, or to have the rate of illumination proportional to the frequency and the speed of the screen strictly constant. The latter plan is adopted in the present instrument, because by so doing we gain the advantage of ease of operation of the rotating element, as described below. The illuminant is simply a tungsten wire two mils in diameter mounted in an atmosphere of ammonia in a small cast-iron container having a glass window.

The Stroboscopic Screen.

The plan of using a drum or disk on which are rows containing different numbers of equally spaced dots and viewing this under intermittent illumination or else under constant illum-

1 Physical Laboratory, National Electric Lamp Association.
2 *Electrical World*, November 30, 1912, page 1146.

ination through the slit of a vibrating tuning fork, is an old one, for example, it is a good way to get the slip of the rotor of an induction motor. A reproduction of a screen suitable for getting speeds of rotation is given by Rayleigh[3], which has 20 rows having from 20 to 41 marks. An excellent improvement was introduced by Seashore[4] in his tonoscope, an instrument for determining the pitch of the voice and other musical sounds. This improvement consists in dividing the rows into two series, the rows of the two series alternating. This has the advantages of giving greater compactness of the instrument and giving an advantageous "framing-effect," because the row of dots which apparently stands still always lies between two rows which show merely as streaks. This plan was adopted in the present frequency-meter. Fig. 2 shows the screen, which was mounted on the surface of a drum five inches in diameter, making one revolution per second. The screen contains 39 rows of dots, the number of dots in a row ranging from 29 to 67. It is thus suitable for indicating frequencies from 14.5 to 134. A 30-cycle current sent through the lamp gives 60 illuminations per second, so that the row containing 60 dots apparently stands still. With 60-cycle current (120 illuminations) the same row appears stationary, but with the dots apparently twice as close together, and with 120 cycles the same row shows standing dots apparently one-fourth their actual distance apart. The rows are numbered on two fixed scales, one for each series. The dots overlap to some extent in the case of the higher frequencies, but this does not interfere at all with the detection of exact synchronism.

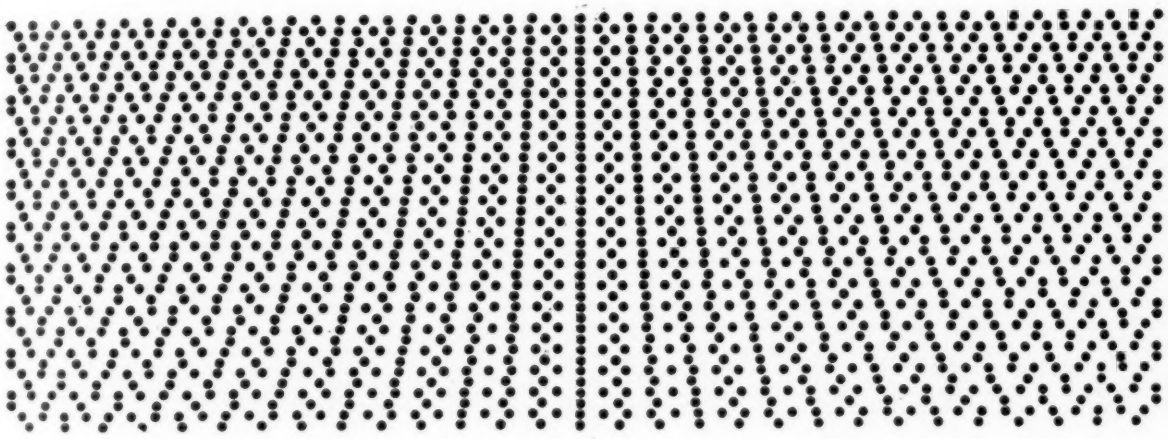


Fig. 2.—The Stroboscopic Screen.

Means of Obtaining a Constant Angular Velocity.

The plan adopted for rotating the drum at exactly one revolution per second consists in directly driving it with a small ten-pole synchronous motor of the attracted-iron type, operated by current impulses given by a vibrator making ten contacts per second. The motor winding and vibrator magnet winding and the contacts in series are connected to the same alternating supply circuit which operates the intermittent light, and of which the frequency is to be determined, so that no separate source of current is necessary; the motor does not run in synchronism with the alternating current but with the impulses given by the vibrator as it chops off groups of waves at a regular rate. A small condenser shunting the contact avoids sparking. The motor is thus a form of the "phonic-wheel" invented independently by La Cour[5] and by Rayleigh[6]—the original synchronous-motor, soft-iron armature attracted by an electromagnet in circuit with a tuning fork. To avoid hunting and to facilitate falling into step, they had on the shaft a flywheel having a hollow rim and containing water or mercury. A departure in the present case consists in dividing the moment of inertia of the system into two parts, one being a small flywheel rigidly attached to the armature shaft and the other the drum on which the stroboscopic screen is mounted, this drum being driven by a flexible connection with the shaft or flywheel fixed to the shaft. This flexible connection must be capable of absorbing some energy—rubber bands serve perfectly; if coiled springs are used a slight braking action between the two moments of inertia must be provided. This arrangement has an advantage over the liquid-flywheel plan in that the drum has a chance to perfectly integrate the impulses, so that it proceeds with great uniformity even though operating on the low frequency of ten impulses per second. To start the motor it is only necessary to give it a twirl with the fingers and let its speed die down to synchronism (one revolution per second). When once the relative moments of inertia of the two parts of the system and the flexible connection are properly adjusted it never fails to fall into step at the first trial.

The instrument as described is thus practically a reproduction on a small scale of the tonoscope of Seashore, to which reference has already been made, and for the driving of which the writer devised the modified "phonic-wheel" arrangement just described. The substitution of the gas-immersed filament in place of the manometric flame, which becomes possible in the frequency-meter because there is no lack of power to light the filament, adds considerably to the simplicity of operation.

Conditions Affecting Accuracy of the Frequency-Meter.

Since the rows of dots corresponding to all the frequencies have the same motion, separate tuning is not necessary. The accuracy can be checked at any time by counting the revolutions (one per second) directly or by comparison with a tuning fork; evidently the constancy of rotation is dependent only upon the constancy of the rate of current interruption. It was found that a simple portable reed-vibrator gives ample accuracy for ordinary work; with a large laboratory tuning fork very high accuracy is obtained. The indications of frequency are evidently independent of the wave-form of the alternating current employed.

3 Rayleigh, *Philosophical Magazine*, Vol. XIII, page 330; 1907.

4 C. E. Seashore, University of Iowa *Studies in Psychology*, Vol. III, 1902, and Vol. VI, 1913.

5 *Electrician*, London, Vol. II, page 75; 1879.

6 *Nature*, Vol. XVIII, page 111, 1878.

BOOK REVIEWS.

"Analytical Mechanics, Comprising the Kinetics and Statics of Solids and Fluids." By Edwin H. Barton. London: Longmans, Green & Company. Cloth, 535 pages (5⅛x8⅛ inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

The book is divided into six divisions: I, Introductory; II, Kinematics; III, Kinetics; IV, Statics; V, Hydromechanics; VI, Elasticity. In the first two chapters, comprising Part I, the author explains the scope of mechanics, the order of treatment and gives a large collection of formulas of pure mathematics which will be needed in the solution of problems or the derivation of formulas for various theorems. Here he introduces one of his tabular forms, of which there are sixteen throughout the book, in which he collects various phenomena, quantities, subjects or terms which bear similar relations to each other in different branches of mechanics. The tables form a valuable feature of the book.

The titles of eight chapters under Kinematics are: Geometrical Basis, Rectilinear Motion, Plane Motion of a Point, Plane Rotational Motions, Solid Motions of a Point, Solid Rotational Motions, Mechanisms and Strains. In this section the laws of motion *per se* are considered. The author starts with the fundamental ideas of space and dimensions, introducing dimensional relations. His discussion of scalars and vectors does not seem full enough for beginners and his proof for the composition of vectors is not sufficient. It would have been better to have cut the discussion of fundamental ideas of units and motion and to have given a larger amount of space to the conception of vectors and their treatment, which are not known by beginners and are so important in the subject of mechanics. Following the fundamental ideas of time the subjects of motion, velocity and acceleration are presented and the use of graphs for the discussion and comprehension of these ideas is made clear. The composition of velocities and accelerations and the use of moments are then treated but in the proofs of the theorems, the reasoning is not always satisfying.

In Chapter IX a very limited view of the motion in mechanisms is given. Important kinematic chains are described and their peculiarities are derived and certain important ideas of mechanism are presented but the chapter is not sufficiently exhaustive if this matter is to be presented at all.

The chapter on strains discusses the deformations of a body without reference to the cause of this deformation. It is a purely geometrical matter and the formulas for various kinds of strains and their composition are developed.

In the chapter on the Physical Basis of Kinetics, the author discusses the conceptions of mass, inertia and force, giving a historical résumé of the conceptions of Galileo, Huygens, Newton, Kelvin, Tait, Macli, Pearson, Love and Lodge. He also discusses gravitation and elasticity. Then follows the discussion of motion and the measurement of time, a general treatment of the various conceptions, ending in a bibliography of the more recent books dealing with the philosophy of mechanics. This chapter is one of the best and most important in the book. It is clear and sufficiently long for the purpose intended.

The Kinetics of Particles deals with the ideas of momentum, impulse, kinetic energy and work and the selection of units for their measurement. The various standard units are explained and the relations between them are shown. It is pleasing to see that the author does not hesitate to use the term "poundal" as the British absolute unit of force. This is necessary to explain the use of g in so many of the engineering equations of mechanics. The absence of this term or name makes it difficult to explain many operations in British units while the use of the dyne and gram in the metric system make the operation clear to students.

The plane kinetics of rigid bodies is concerned with rotation around axes and introduces the ideas of moments of inertia and of torque. The relation between simple motion or kinematics and mass motion or dynamics is well illustrated in a table.

The chapter on solid rigid kinetics deals with the motion of the gyroscope as illustrating the space motion of a solid. Angular momenta are computed and combined and the analogous relations between linear and angular quantities are illustrated.

The chapter on attraction and potential establishes conceptions of fields of force, tubes of force and the ideas of potential and equipotential surfaces.

The chapter on plane statics of rigid bodies deals with the resultant of parallel forces, the couple and finally the conditions for equilibrium. A discussion of graphic statics, the use of the force polygon, the frame polygon and the equilibrium or funicular polygon is given in seventeen pages. The chapter is closed by the construction of bending moment and shear diagrams with practically no application of these to actual problems nor any indication of their extensive use.

Two chapters are devoted to hydromechanics. The first deals with hydrostatic pressure, surface tension and surfaces of fluids in motion while the second deals with the equations of continuity, of motion and of the relation between pressure and density. These are then applied to the derivation of equations of steady motion of fluids, of the motion around bodies and of the motion of viscous fluids. These chapters are so short and there is so little indication of practical applications that one wonders why they are introduced at all.

The section on elasticity contains only one chapter on the statics of elastic solids.

Following the text is a large and valuable collection of problems covering the whole field of mechanics. These are followed by a page of mechanical constants of conversion and tables. It is regretted that in the table of constants the gallon is not marked "Imperial" to distinguish it from the United States gallon, that the value 774 is given for the mechanical equivalent of heat and that the Fahrenheit unit of heat is not given in a definite form.

An excellent index which will average more than two references to the page of text is found at the end. An index is the important part of such a book and the author has made this complete. The problems and questions given throughout the text at frequent intervals are primarily on the portion of the book in which they occur. They are natural questions on the text covered. There are occasional questions on the application of the text to matter not given, requiring original thought.

The book is well written and there are very few typographical errors. At places, however, there is a lack of clearness or fullness so that very close attention is necessary to grasp the full meaning. The statements made at several places, that the proofs of certain theorems given are beyond the scope of the book, is not good. If the proof cannot be given in good form or is beyond the training of the student for whom the book is intended, it is well to omit the theorem. The work has a scope of several textbooks and it seems rather unnecessary to give a few fundamental ideas of mechanisms, potential, graphic statics, resistance of materials or hydromechanics and to omit the applications and important relations of these subjects which are so important to the engineer. The book appears to be one intended to give the student a certain amount of training in applied mathematics without the intention of applying this to everyday problems. The text is full of references to the best and most modern special works on the various divisions of mechanics so that the student may pursue any line of work further. The author has covered a vast field and shows a thorough knowledge of that field in all of its details, but the writer believes that it would have been better to have had a more exhaustive treatment of a restricted portion.

As a reference book the work is very valuable to American students, but as a

textbook for colleges in this country it is too broad and does not thoroughly develop the subjects.

ARTHUR M. GREENE, JR.

"Transmission-Line Formulas." By Herbert Bristol Dwight. New York: D. Van Nostrand Company. Cloth, 137 pages (5½x7¾ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

The instructions and formulas contained in this book are for use in electrical calculations for transmission lines. The mechanical aspects of overhead lines are not considered. The book is intended for electrical engineers and engineering students. It is divided into two main parts. Chapters I to VI inclusive explain the use of charts and working formulas; while Chapters VII to XV deal with theories, and explain the mathematical derivation of the formulas. The engineer will find in Part I all that he requires for the rapid and correct solution of practical problems; but he will probably have little use for Part II. The student, on the other hand, would be well advised to short-circuit Part I and seek mental food and refreshment in Part II. He will require a taste for correct mathematical reasoning and some facility in mathematical operations; but, given these desirable tendencies and aptitudes, he should derive great benefit and pleasure from the perusal of the chapters dealing with theories and the derivation of the practical formulas.

One of the best things in the book is the regulation chart, which has been carefully worked out, and gives surprisingly accurate results in a surprisingly short time. In Chapter IV, simple formulas are given for calculations on short lines (not exceeding 20 miles long); and for complete and accurate solutions of high-voltage long-distance transmission problems, the so-called *K* formulas of Chapter V are admirably adapted. In Chapter VI the hyperbolic formulas which take exact account of all the electrical properties of transmission lines, are expressed in the form of convergent series: the chief object in view being, presumably, to avoid the necessity of referring to tables of hyperbolic functions. The practical engineer will probably have little use for this chapter, seeing that the chart and the *K* formulas are sufficient for his needs.

Mr. Dwight's formulas, when used for the calculation of current, give the result in "total amperes." This is a term which appears to have no physical meaning when used in connection with polyphase systems. The in-phase current in total amperes is defined as the ratio of the real power (in watts) to the voltage between wires: the current per wire can, however, readily be derived therefrom.

On the assumption that the wires of a three-phase system are transposed at regular intervals, Mr. Dwight shows that, with irregular spacing of the conductors, all calculations, whether for inductance or capacity, can be based on the assumption of equidistant spacing *s*, where $s^3=a\ b\ c$, and *a*, *b* and *c* are the actual distances between pairs of conductors. This is not generally known.

The author is to be congratulated on having collected in a handy and useful volume the results of much careful and conscientious work.

A. STILL.

"Valuation of Public Service Corporations." By Robert H. Whitten. New York: The Banks Law Publishing Company. Cloth, 720 pages (5½x9 inches). Supplied by the Electrical Review Publishing Company for $5.50.

Perhaps no student of public-utility regulation has been as carefully trained for this particular work as has Dr. Whitten. His broad education, his experience as legislative reference librarian at Albany, and the unusual opportunity given to him as librarian and statistician for the Public Service Commission, First District, New York, to surround himself with what is probably the best public-service library in America, make him an authority to be greatly respected. His work with the Commission has always been much broader than his title has implied. The Commission, early in 1907, realized the importance of a fully equipped library and of a specially trained librarian, and Dr. Whitten was appointed and has always had the full co-operation of the Commission. The routine and detail work of the library has been taken care of by assistants, thus leaving Dr. Whitten free to devote his entire time to constructive public-service study and compilation. Many of the reports and opinions of the Commission have been briefed by Dr. Whitten and his advice and opinion have been freely used by the Commissioners. It is perhaps not going too far to say that the position of the Commission on such matters as the recognition of going value and its treatment of appreciated real estate, have been largely influenced by Dr. Whitten's own study and conclusions upon these subjects.

As to the book itself, as a book, it is beyond criticism. It is admirably arranged, carefully annotated and indexed and as the references have been most carefully checked, the book is absolutely reliable. It is rare to pick up a public-service brief or opinion issued since this book, without finding one or more quotations from Whitten, and this shows the necessity for, and the appreciation with which the book has been received by those engaged in regulation work. In the very completeness of the book, however, lies its principal danger. As one turns its pages, the valuation of public-spirited corporations seems to be a very definite and settled matter. The quotations given in the book upon any disputed point can be carefully weighed by any untrained observer, a general average can be made, and presto, the long disputed point is settled.

Let us stop a minute and consider what is gathered together in Dr. Whitten's book. First we have the court decisions. These have mainly been handed down in cases arising under the fourteenth amendment and involving the confiscation of property, and in general the courts have decided that it is doubtful if confiscation exists, and therefore such decisions are, on the whole, unfavorable to the corporations. But there is a great difference between a determination of what is confiscation and the determination, by a fair body, of a just and reasonable rate.

On the other hand, we find in the book quotations from the early commission decisions. Here again it must be remembered that important regulation decisions did not really begin until 1908, and while regulation did exist earlier than this, it consisted mainly in an effort on the part of the existing commissions to dodge every issue that was presented, and, even if in their reports they informally discussed the questions involved in a case, they were very careful in handing down their decisions not to predicate them upon the given reasons.

Dr. Whitten's book, therefore, as it represents the best opinion on the determination of a fair valuation, gives us only the pioneer statements of commissions, which are just beginning to learn what valuation means, and who do not as yet know what will be the result of their opinions, for valuation itself did not really begin until about 1900, as before that date the so-called valuation was merely appraisal or an individual's guess or opinion as to the value of property.

It should therefore be pointed out very clearly that while, in this excellent book, Dr. Whitten has gathered together the result of the scattered opinion, which has heretofore been very difficult and often impossible to obtain, it is fundamentally wrong to average in any way or carelessly to bring together for comparison the opinion of courts in cases of confiscation, and the opinions of commissions in their early endeavor to determine fair rates.

A careful study of the tendency of the references quoted in Dr. Whitten's book leaves a decided impression that public-service regulation, as it applies to the valuation of public-service properties, would be drastic in its effect upon even the most conservatively financed and operated utility. In actual practice the commissions have not acted in a manner nearly so drastic as a logical conclusion from Dr. Whitten's book might imply. This is especially noticeable since the book was published, as in such decisions as the Patterson-Passaic gas case of the New Jersey Commission and the Consolidated Gas and Electric decision of the Maryland Commission. The commissions have not

hesitated, in order to deal fairly with the companies, to make liberal allowances all along the line or even to throw overboard or even to reverse the accepted conclusion in any particular point. This is noticeable in the Baltimore decision, where $5,000,000 was allowed for franchise easements which had been heavily taxed by the city.

It must also be borne in mind that every individual rate case which necessitates a valuation must be judged upon its own merits rather than by the decisions in other cases. A rule might be applied with perfect fairness to one company and be out of the question with another. This is perhaps best explained by a concrete example. Electric light is supplied by an antiquated plant and a worn-out distribution system at a low rate. The valuation of such a property for rate-making purposes might show today a value of less than 50 per cent of original cost and it is to be presumed that the rate would be based upon such a valuation. Of course the company was improvident and laid aside no funds for a depreciation account. This in itself presents an interesting and complicated rate problem. Now suppose such a plant were purchased by an adjoining company and a modern transmission line introduced into the town, the local plant abandoned and the entire distribution system rebuilt. Nothing remains physically of what the company has purchased, and the valuation for rate-making purposes made immediately after the new operation would allow nothing for the old plant, if the court and commission decisions were followed. It might be said that the 50 per cent of value mentioned above has disappeared overnight. The commissions in making a proper and fair decision in such a case must utterly disregard the logic of decisions of courts and commissions in other cases. If this is not true, progress will be stopped. Our most enlightened commissions have realized this and it can be expected that in the future they will recognize that oftentimes good service is of more importance to the public than is the lowest possible rate.

It is a grave mistake therefore to believe that on account of the excellent arrangement and splendid typography of Dr. Whitten's book, that the valuation of public utilities is a settled matter and the precedents thereby laid down have finally determined the many intricate questions involved. This book should be considered as the best available guide to the pioneer work in a most complicated subject, and if the book encourages those who have been given authority in regulation matters, to think and study and to honestly and fearlessly work out their own conclusions as to what is right and fair in the valuation of public-service properties, it will accomplish much. If, on the other hand, it is lazily used as a book of last resort by those in authority, it cannot fail to do a great harm at the very beginning of what is destined to be perhaps the most important function of utility regulation.

WILLIAM J. NORTON.

"Alternating Current Machinery," By William Esty. Chicago: American School of Correspondence. Cloth, 467 pages (6¼x9⅜ inches), 400 illustrations. Supplied by the Electrical Review Publishing Company for $3.00.

This is a book of practical nature intended for the beginner and the so-called practical electrician who may desire a working knowledge of alternating-current apparatus. The beginner is presupposed to have a working knowledge of algebra, geometry and trigonometry before he can read the book to any advantage.

In the first few articles some of the theoretical principles of alternating currents are discussed. Following this the author has a very good, though necessarily brief chapter on electrical measuring instruments. In Part II the author takes up the discussion of alternating-current apparatus beginning with the alternator. According to the statement in the preface, the discussion of any class of apparatus is to give (*a*) the physical theory of each class of apparatus; (*b*) the applications, behavior, and operations; (*c*) the structural details of commercial types; and (*d*) the methods used in making usual tests. An examination of the text shows that this method of treatment has been applied to alternators, synchronous motors, transformers, rotary converters, and induction motors. Some 37 pages are devoted to switchboard and station apparatus and in an appendix are given some brief instructions about parallel operation of alternating-current generators.

While it is extremely difficult and perhaps impossible to write a text on alternating currents in such a form as to stimulate inquiry on the part of the practical man, nevertheless it seems to the reviewer that the average "beginner" will have considerable difficulty in understanding the theoretical principles discussed, and unless these principles are understood in their physical relations, their expression in algebraic formulas will be of no great value. About the only criticism that one can offer is on this assumption that the expression of physical relations in algebraic forms is sufficient for the student to acquire a working knowledge of them. The treatment of the commercial apparatus is very good indeed and will undoubtedly be very helpful to anyone who may have such apparatus in charge.

C. M. JANSKY.

"Bells, Indicators, Telephones, Fire and Burglar Alarms, Etc." By J. B. Redfern and J. Savin. New York: D. Van Nostrand Company. Cloth, 123 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company for 50 cents.

Either the desire to present a new subject or to treat an old one in an original and helpful manner may be sufficient to justify an author to undertake the preparation of a book. As is indicated in the title, this book deals with no subject that is new. In most instances, however, the treatment is especially good. While they were preparing the copy, the authors evidently kept in mind, as the reader whom they wished most to help, that type of practical electrician who knows as much of the fundamental laws of the electric circuit as he needs to carry him through the day's work, but who is not familiar with the details of construction and installation of the apparatus about which the book is written.

The discussion of fire alarms is practically without value. In fact, but two pages are devoted to this. But in the case of the other topics the text is of a kind which makes it comparatively easy for the reader to get a working knowledge of the installation and operation of the apparatus or appliance with which the discussion has to do. There is a total of 85 wiring diagrams and line drawings on the 123 pages. These are all of a good, practical sort.

Some 42 pages of the text are devoted to electric bells and annunciators, two pages to fire alarms, about the same amount of space to burglar alarms, and the rest to the telephone. In reading the book one gets the impression that the section taken up with the telephone alone is worth the publisher's price.

Failure of Iron Smelting in Norway.

It is reported that the Electric Iron Smelting Company Hardinger, of Norway, has, after nine month's operation, been forced to close down. The process used by this company for smelting iron ore was the one developed in Sweden and successfully used there.

The reason given for the failure of this process in Norway is the lack of suitable raw materials. The Swedish electric blast furnaces are charged with charcoal, which is readily available there, but which cannot be obtained at a reasonable price in Norway. The Norwegian plant was, therefore, using coke and this was found to be unsatisfactory, in conformity with the original experiments in the development work at Trolhättan.

New Electrical and Mechanical Appliances

Beardslee Brass Fixtures for Indirect Lighting.

The growing popularity of indirect lighting is calling for a greater variety of indirect-fixture designs to satisfy the extremely varying conditions and tastes met with in different installations. Among new, and in many ways, unique, designs is an attractive line of such fixtures done in brass that was recently placed on the market by the Beardslee Chandelier Manufacturing Company, 225 South Clinton Street, Chicago. The aim in getting up these designs was to provide original fixtures of artistic outline and durable metal construction and yet reasonable price. The designs are unique, but not odd or extreme. They fit well into the general decorative plan such as an average buyer is most likely to provide for his residence.

Fig. 1.—Classic Design.

Fig. 2.—Arts and Crafts Design.

Fig. 3.—Mission Design.

In the three illustrations herewith are shown suggestions of the variety of designs in this new fixture line. The one shown in Fig. 1 is a rich classic pattern treated so as to harmonize with modern furnishings found in the better homes. The full length of this fixture is 33 inches and the diameter of its bowl is 18 inches. The canopy and bowl are made of sheet brass in which the decorative details of the design are sharply brought out. The finish is a high-grade brush brass and black finish. This fixture is suitable for three 60-watt tungsten lamps equipped with high-efficiency reflectors.

Fig. 2 is an attractive arts and crafts design particularly suited to a small den or library or a long, narrow living room of the bungalow type in which two fixtures are hung. The length of the fixture is 30 inches and the body is 10 inches square. This fixture also is made of sheet brass, but the shields are of cast brass. The finish is either entirely in brush brass or brush brass and black. A 100-watt tungsten lamp with reflector is appropriate for this fixture. The reflectors provided are of the opaque silver-mirrored glass type.

In Fig. 3 is shown a unique design in the mission style. It is particularly suitable in bungalows, rooms finished in mission style, and small theaters where the decorative plan is along simple lines. The length of the fixture is 30 inches and its extreme spread is 23 inches. It is made entirely of sheet brass with brush brass finish. Four 60-watt lamps and reflectors are easily accommodated.

Load Boxes for Testing Meters in Place.

When meters are tested in place on the customer's premises, it is no longer the practice to carry a group of incandescent lamps to serve as an artificial load for the meter. Very compact and relatively light-weight testing rheostats, termed load boxes, are now provided for meter testers by all the progressive central-station companies. They greatly facilitate and reduce the cost of testing meters.

When alternating-current meters supplied through current and voltage transformers are to be tested, a "phantom" load box is employed which takes a relatively small current through the voltage transformer and transforms it to a low-voltage current of amperage sufficient to test the various important loads on the meter.

Typical load and phantom load boxes used by the New York Edison Company were described in a recent issue of *The Edison Weekly*.

Electric Boiler-Firing Indicator.

The Niclausse boiler-firing indicator is a new electrical apparatus for securing a more regular firing of the furnaces than is usually in vogue at present, and is intended to be used in any kind of steam plant where hand firing is employed. It consists of two devices, one of which is mounted in the engine room and can be regulated by the chief engineer, while the second device is placed in the boiler room so as to

give signals to the stokers for firing coal to the furnaces. The indicator in the engine room is placed at a central point near the pressure gauges and at the engineer's hand. The engineer has a board upon which is a table showing the number of furnace charges per hour to be adopted so as to obtain the different rates of combustion per square foot of grate surface and in consequence the different rates of steam production. From time to time he sets the automatic indicator so as to give, for instance, 15 charges of the furnaces per hour, or any other rate. Such signals are sent to the furnace quarters by a rotating-disk electric device which is illustrated in Fig. 1.

It consists of a box containing a

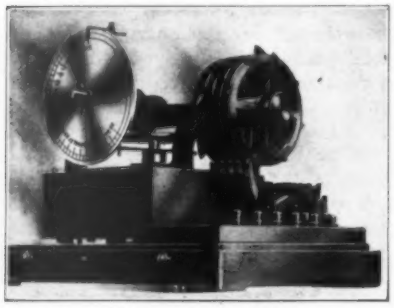


Fig. 1.—Indicator-Control Mechanism.

clockwork movement for running the device, and the clockwork turns a vertical shaft whose movement is transmitted to a horizontal shaft carrying a set of electric contact disks, through a friction plate and roller which can be adjusted by hand so as to give different speeds to the disks. On the shaft are mounted as many disks as there are furnaces, also an extra disk. The device shown here carries five disks and serves for four furnaces. On the main disks are two cam projections each, which act on the corresponding levers on the base for opening and closing

Fig. 2.—Indicator in Boiler Room.

electric circuits running to the luminous indicator in the boiler room, while the fifth or outer disk has eight cams for closing an electric bell circuit at the same time as the lamps are lighted up. The whole device is inclosed in a tight box and all the adjustments are made from the outside. The rate at which the disk set revolves, and consequently the rate of firing, is adjusted by the use of a dial carrying sets of numbers. Turning the dial causes a friction roller to move upon the horizontal disk so as to work the roller at a greater or less distance from the center, and thus to vary the speed on this well known principle. In this way the automatic signal device gives the number of furnace charges per hour, this being indicated by the apparatus seen in Fig. 2, placed in the furnace room. It consists of one or more iron boxes carrying as many luminous panes as there are furnaces. Each section shows that furnace No. 1, No. 2, etc., is to be fired, and also the number of shovelfuls in each charge. At the moment when the first disk makes contact, section No. 1 lights up and indicates that 5 shovelfuls are to be charged into furnace No. 1, an electric bell ringing at the same time. Pilot lamps in the engine room show when all is working well. On the luminous indicators the figures for the number of shovelfuls can be changed as desired by turning the button which is noticed opposite each. Should there be any differences in the grate areas, there can be used four or six shovelfuls, for instance, instead of five, for some of the furnaces.

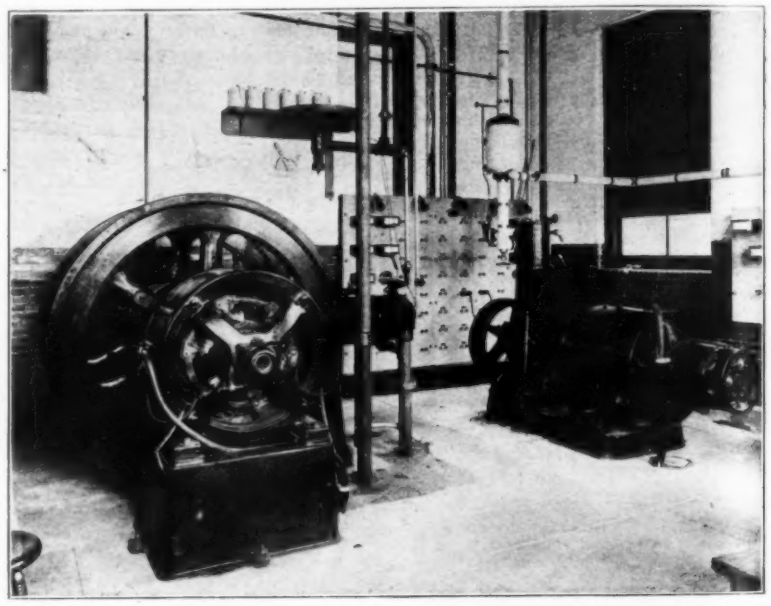
Generating and Switchboard Equipment for a High School.

Modern high schools and academic institutions all over the country, more especially those in which manual training is a part of the curriculum, are installing completely equipped electrical laboratories for the benefit of students. The illustration shows a corner of the electrical laboratory of the West Philadelphia High School, a new and modern structure situated on Forty-sixth street, Philadelphia. On the left of the picture is shown a Diehl 10-kilowatt, 125-volt 250-revolution-per-minute direct-current generator coupled to an Otto gas engine. On the right is shown a Diehl 10-kilowatt, 400-revolution-per-minute, 125-volt, 60-cycle, single-phase generator mounted on the shaft extension of which is a 1.125-kilowatt exciter. This apparatus is mounted on the same bed plate with and coupled to an A. B. C. steam engine.

Students are thus enabled to study the characteristics of both alternating-current and direct-current generation and can observe the relative merits of steam-engine and gas-engine drive.

The switchboard shown consists of three panels on which are mounted the necessary instruments, field rheostats, switches, ammeters, voltmeters, etc.

The panel on the left controls the output of the direct-current generating set and the one on the right the output of the alternating-current set. The central



Generating Equipment in West Philadelphia High School.

panel acts as a neutral distributing board having receptacle inlets numbered identically with those in the alternating-current and direct-current boards. These numbers correspond with receptacles placed at convenient points about the laboratory and in close proximity to the students' benches. Thus, by bridging from right or left to the central board by means of cable and attachment plugs, either direct current or alternating current is supplied to any or all benches.

The entire electrical equipment was furnished by the Diehl Manufacturing Company, of Elizabeth, N. J.

Although its population is over 2,000,000, St. Petersburg, the capital of Russia, has now only about 50 miles of street railways.

Detroit Electric Vehicle Bodies Made of Aluminum.

The Anderson Electric Car Company, manufacturer of the well known Detroit Electric, has an aluminum plant connected with its large factories, which is quite novel and interesting.

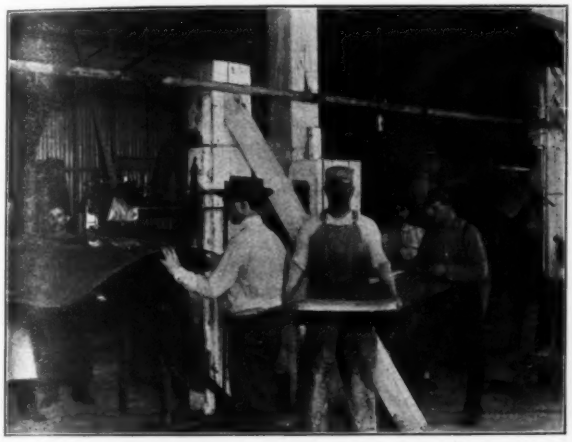
Special pressing machines and automatic hammers have been designed by the company's engineers to handle and form the large aluminum plates to fit the special contours of Detroit Electric bodies. The panels, roofs, and window-sash fenders and even the hub caps of these cars are now made entirely of this metal.

For this purpose aluminum possesses a number of advantages, among which are its extreme lightness combined with strength, it will not warp, it is unaffected by weather conditions, does not rust nor wear, and permits of an unexcelled, non-cracking satiny finish. For fenders, it is extremely valuable because, lacking vibration, it is noiseless. Aluminum possesses the added quality of being malleable, like gold; hence the graceful lines of the Detroit Electric.

The roof of the car is a single plate of aluminum formed in special hammering and pressing machines to meet the roof lines. This roof cannot leak, nor weather. Each aluminum window sash is also of one piece, having no joints to open up, swell or warp like ordinary wood sash.

This large use of aluminum in the Detroit Electric is consistent with the general policy of the Anderson Electric Car Company to produce the highest type of electric automobile, to build into the car the finest materials. This concern has designed and is building all the individual parts for its cars.

At its Cleveland factory, formerly the Elwell-Parker Electric Company of America, it is manufacturing its own motors and electrical equipment. The Detroit plant is possessed of 12 acres of floor space and herein are combined machine shop, chassis department, battery department, mill, dry kilns, and wood-working, aluminum, upholstering, fender and painting departments, etc.



Shaping Aluminum Vehicle Bodies.

Assembling Room and Stock Room, Aluminum Vehicle Bodies.

Useful Applications for Stock Motors.

The popularity of small electric motors in the home, store, office and garage has been greatly extended by many uses in which ordinary stock motors can be applied to various devices. In a great number of instances, home-made devices have been constructed, and these are operated by electric motors, such as the home-made vacuum cleaner described below.

With a little mechanical ability and inexpensive materials, this device for making the housekeeper's work easier was built by its owner. A reproduction of the vacuum cleaner is shown in Fig. 1 and a sectional sketch in Fig. 2. The dust receptacle, motor and fan are mounted on a rolling platform. There is a cylindrical tank, *a*, a volute fan *b*, which draws through the dust bag *c*, and discharges through the outlet *d*. The partition ends are of wood, fitted so as to be air-tight. The motor runs at 1,120 revolutions per minute and operates the fan at 3,000 revolutions per minute through a rawhide gear. The dust bag is held by a wire ring *e*, which fits into an angular groove *f* in the wood seat. The head *g* is held in position by carriage bolts *h* and wing nuts, and the felt washer *i* makes the joint air-tight. A Westinghouse one-sixth-horsepower motor is attached to the vacuum-cleaner platform by bolts and wing nuts so that it can be easily removed from it for other purposes.

An automobile enthusiast has solved the problem of inflating tires properly without physical exertion and in the least possible time by a simple arrangement shown in Fig. 3. The outfit consists of a Westinghouse one-eighth-horsepower motor geared to a small pump of the reciprocating type, mounted on a portable wooden base. The pump is very rapid in operation and gives a steady flow of air. The motor is small and quiet running.

Fig. 1.—Home-Made Vacuum Cleaner.

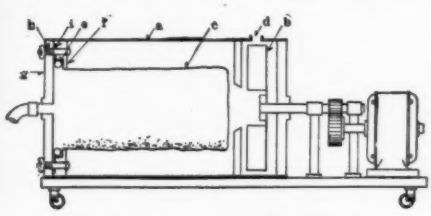


Fig. 2.—Section Through Cleaner.

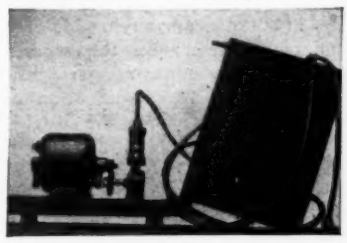
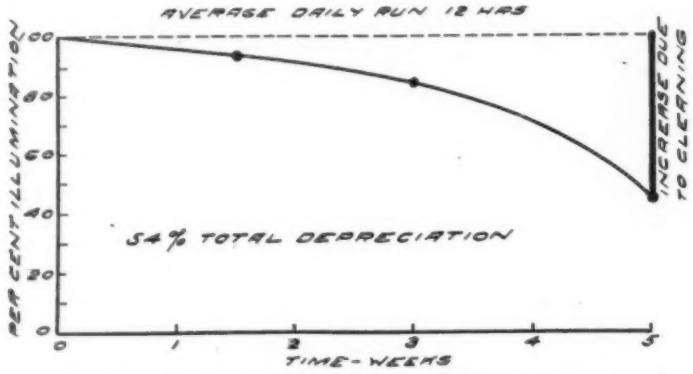


Fig. 3.—Motor-Driven Tire Pump.

Successful Use of Myrlite for Various Cleaning Purposes.

Persons in charge of lighting installations seldom realize the very depreciating effect upon the useful light obtained from any type of illuminant brought about by accumulation of dust on lamps, globes, reflectors or shades. The importance of cleaning windows is generally realized in the higher class of buildings, both for the sake of appearance and for permitting daylight to shine in unobstructed. It is equally, if not more, important to clean the artificial lighting equipment in order to let the light shine out freely from the lamps.



Curve Showing Acquired Depreciation of Lighting Equipment.

This is very forcibly shown by some tests conducted in an industrial establishment. Three types of lamps, luminous or magnetite arcs, flaming carbon arcs and mercury arcs, were in use in different parts of a large foundry, all being subjected to about the same amount of dust, smoke and vapor. The magnetite and flaming-arc lamps had their globes wiped out as usual at each trimming, but no attempt at thorough cleaning was made until the end of the fifth week. The acquired depreciation or loss of light was about the same for each type of lamp and is shown graphically in the accompanying diagram. Illuminometer tests on the working plane were made under regular operating conditions. The illumination obtained at the beginning of the test with all lamps thoroughly clean was regarded as 100 per cent. At the end of five weeks the equipment gave less than half this amount of illumination! Such conditions are unfortunately only too common.

In the issue of November 9, 1912, mention was made in these columns of the development of a new cleaning preparation called Myrlite. At that time it was stated to be peculiarly suited for the cleaning of lamps, globes, shades, reflectors and other illuminating glassware. This has been verified by the experience of many hundreds of users, who have found it an extremely convenient and time-saving adjunct for the lamp trimmers and lighting-equipment maintenance force. Not only does it facilitate the cleaning of all kinds of glassware, but it cleans it more thoroughly than can usually be done with soap or similar cleaning agents, which leave a film on the surface that readily attracts fresh dust and dirt. Moreover, it cleans mirrors and other sensitive glassware without producing even microscopic scratches which are so commonly formed when most cleaning agents are employed.

Myrlite is an insoluble neutral mineral carbonate free from all objectionable ingredients. It is found in considerable quantity in the vicinity of Pownal, Vt., where its producer, the Myrlite Company of America, makes its headquarters. It is put up in conveniently applicable liquid form. For trimmers there are provided half-pint or pint tubes with screw spout. It can also be procured in gallon cans. It is applied to the surface on a damp cloth and then the article is wiped dry, little rubbing being needed.

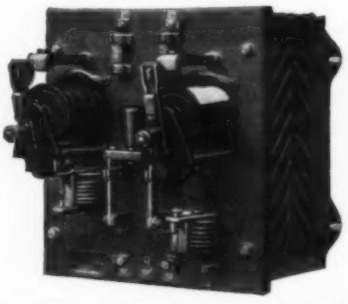
Myrlite has also come to be successfully used for cleaning marble floors and wainscoting, paint or enamel surfaces, headlights and windshields, general domestic work, as well as a hand cleanser, using either fresh or salt water.

An Electric Ship for Canada.

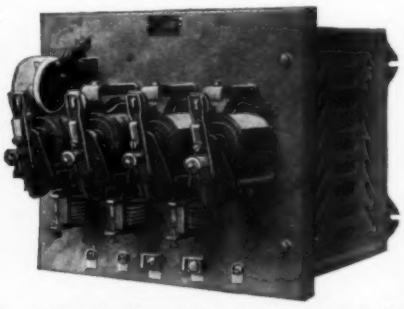
There was recently launched the first ship for Canadian waters to be equipped with oil engines, generators and motor-driven propellor. It is the *Tynemount*, a steel freighter of 250 foot length and 42.5 foot breadth for the Montreal Transportation Company. There are provided two Diesel engines, each of 300 brake horsepower and running at about 400 revolutions per minute. The propellor speed will not exceed 80 revolutions per minute. The electrical transmission system was designed by H. A. Mavor, of Glasgow.

New Automatic Motor Controllers.

To relieve workmen of the responsibility of starting and stopping motor-driven machines, automatic controllers have come to be used to a considerable extent. Besides making it easier for the operator, they insure the proper acceleration, prevent damage to motor and machine and save time. The accompanying illustrations show two new types of automatic series-relay motor controllers made by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. With this type of controller the resistance is cut out of circuit and the motor automatically accelerated, the starting current, however, being kept below a safe maximum value. The magnetic switches close in succession controlled by the motor current through the relays. These relays are quick and positive in action so that when the motor starts under light load, it will be accelerated quickly, while if under heavy load the resistance is cut out more slowly, but in all cases the current to the motor is kept to a safe value. Where the load driven varies this type of starter is especially adapted as there is no danger of the operator damaging the motor or machine through improper starting; he is relieved of responsibility and needs only to close the switch, the starter does the rest.



Automatic Motor Controller With Main Knife Switch.



Automatic Motor Controller Governed by Remote Switch or Push-Button.

The smaller controller is made in capacities up to 15 horsepower for 110, 220 and 500-volt systems, while another class having main-line magnetic switch is made in larger capacities. With push-button control the automatic controller itself can be placed out of reach.

Connecticut Mica Sockets for Outdoor Festoon and Other Decorative Lighting.

The approach of the summer season always calls for convenient and quick means for stringing decorative lamps for outdoor festivals, carnivals, lawn fetes, concerts and picnics, as well as for more permanent installations, such as festoon street lighting, and special decorative lighting in summer amusement parks. To facilitate this work the Connecticut Electric Manufacturing Company, Bridgeport, Conn., has placed on the market a line of molded mica sockets and appropriate appurtenances therefor.

As shown in Fig. 1, these sockets are of very simple construction. Two metal terminal clips project from recesses in the top and along each of these is a groove or shoulder for receiving the circuit wires, which should be stranded. The method of installing the sockets is extremely rapid, particularly for temporary installations. A sharp awl is used to pierce through the insulation and between the conducting strands, and into the holes thus made the terminal clips of the socket are inserted, as shown in Fig. 2, and bent over and pressed around half of the wire, as indicated in Fig. 3. For a temporary job the sockets can be wired up in this manner at appropriate distances between parallel wires, with extraordinary speed and the job is neat in appearance.

Fig. 1.

Fig. 2.

Fig. 3.

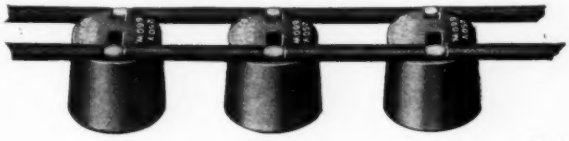


Fig. 4.

Fig. 5.

Where a more permanent installation is called for the insulation is stripped from a very short section of the wire, the socket clip bent over it and soldered in place, thus producing a firm and strong joint, such as shown in Fig. 4 in which the sockets are spaced four inches from center to center. A still more rugged construction is shown in Fig. 5; here the sockets are installed as in Fig. 4, but a cap is cemented over the top of each socket after the clips are soldered. For both of these methods for permanent wiring solid conductors may be used.

To aid in stringing the wires a set of porcelain cleats with properly spaced runways for the wires has also been placed on the market. Two methods are provided for supporting these cleats. In Fig. 7 the cleat is shown with a set of hooks for hanging over a messenger strand or supporting cable; the hooks are so arranged that swaying from wind will not cause them to become disengaged. In Fig. 6 the cleat is provided with a strap that may be secured to a wall, post or other structure. The seats on the cleats are arranged crosswise so that the supporting strap or hook block may be placed parallel with the wires or at right angles thereto.

These Connecticut sockets may be obtained with or without caps and they may also be ordered already wired to either No. 14 or No. 12 stranded, rubber-covered wire.

Responding Electric Push-Button.

United States Consul Walter A. Leonard, of Stavanger, Norway, reports that an electric push-button devised to indicate a return signal has been invented by a Norwegian electrician. The apparatus is a very simple contrivance which can be attached at a slight cost to any push-button connected with an electric bell.

By means of an electromagnet, directly behind the signal button, a dull buzzing sound makes known whether the person called is present. Besides assuring the one signaling that he has been heard, it will save the one called the annoyance of listening to repeated ringings. The convenience should appeal especially to physicians and others who may be summoned during the night. The appliance can be used in connection with call buttons in hotels, ships, or other places where the employee called can not always immediately respond by his presence.

A patent has been taken out in Norway, and applications filed in England and Germany.

Automatically Replaced Electric Signal Lamps.

Oscar D. Plummer, foreman of the electrical laboratory of the Pennsylvania Railroad Company's test department, and two of his assistants, George H. Hausser and E. A. Werner, have invented what is called an automatic electric signal lamp, which promises to aid considerably in the department of railway signal lighting by use of incandescent electric lamps instead of oil lamps.

For several years past the different railroads throughout the country have been experimenting with different types of signal lamps, having several incandescent lamps installed in them, with all lamps burning. The idea was that in case one lamp burned out, the other would keep the signal lighted until the repairman would get around and renew the burned out lamp. These devices have been unsatisfactory from a safety standpoint, due to the fact that both lamps were burning all the time and, since their hours of useful life are about the same, there was danger of both lamps burning out about the same time, leaving a dark signal, which causes delay in train operation.

In this new device these troubles are overcome by the use of a disk holding four lamps, one lamp burning in focus with the signal lens; the other three lamps are in reserve. When a burnout occurs the bad lamp is immediately thrown out of focus and a good lamp substituted. This practically eliminates one of the greatest troubles now being experienced, that of maintaining a lighted electric signal regardless of lamp burnouts.

This new device has met with the approval of the Pennsylvania Railroad signal engineers at Philadelphia, and a number are now being made in the electrical department of the Altoona shops and will be given a trial on the Middle Division. If successful, thousands will be used on the Pennsylvania Railroad.

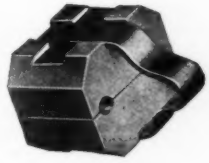


Fig. 6.

Fig. 7.

SINGLE-PHASE HIGH-TENSION OUTDOOR SUBSTATIONS.

By H. W. Young.

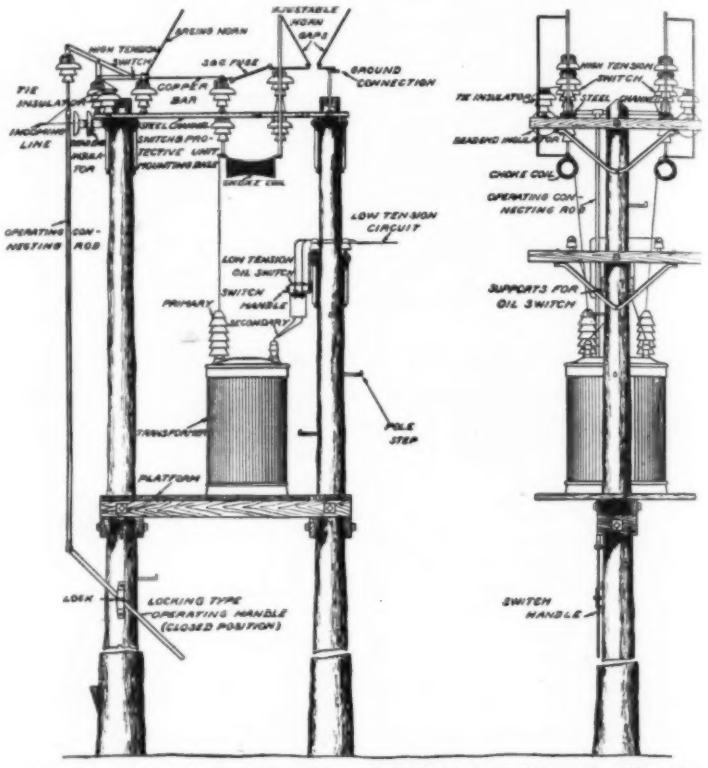
Many central stations when developing new business to be supplied from high-tension transmission systems have found that frequently the initial cost of equipment and maintenance expense has been so high that a fair return could not be secured on the investment. With the earlier types of switching and protective equipment it was almost imperative to build a housing for the oil switches, as their design did not really permit the construction of strictly weatherproof switches that could be sold at a low price. While the indoor type of oil switch was lower in cost than the weatherproof forms yet the expense of providing a house often exceeded that of the switch itself, and in addition it required regular inspection of contacts, oil and bushings. The factor of safety secured was also comparatively low, unless a large and cumbersome construction was employed. As a result oil switches, when neglected in isolated installations, frequently gave serious trouble and interruption of service.

The fuse and static or surge protection originally used was also a commercial handicap to high-tension extensions, as it had a high initial cost, required regular inspection and adjustment, and resulted in a high upkeep cost. It is not surprising, therefore, that some of the earlier outdoor high-tension substations proved to be unremunerative and many central-station managers began to believe such service was undesirable. During the past two years, however, rapid progress has been made in the design and development of lower priced and simpler equipments, which have revived the interest of managers in high-tension distribution. The air-break switch has been perfected so that it can be used to open loaded circuits and also be purchased and installed at such a price that the cost per kilowatt is reasonable.

The air-break form of switch has certain inherent advantages which peculiarly fit it for outdoor service, while the oil switch has certain characteristics which seriously handicap it in this case. A brief comparison of the two types can be made as follows:

The use of air-break switches decreases troubles and interruptions by permitting opening under any conditions without interference with service or deterioration of switches. The arc is broken in large air gaps and there is ample spacing between leads; thus flashovers between leads and mountings are prevented, high and permanent insulation is maintained, and freedom from deleterious cold-weather effects is secured. Inspection is easily and safely made, because there are no concealed parts and "killing" of the wire is unnecessary. The net result is that low initial and installation costs and also low maintenance cost are assured, together with elimination of frequent interruptions.

On the other hand, the use of oil-break switches increases the liability of troubles and interruptions from partial or total failure when opening circuits, because of some of the following inherent weaknesses: dirt or water in oil, oil leakage, small spacings between leads producing flashovers, easily broken entrance bushings, frozen oil preventing proper switch operations. Inspection is made difficult and dangerous, because of the many concealed parts; the oil level is not easily determined and "killing" of the line is necessary. Therefore, the net result with oil switches is high initial and installation costs, together with high maintenance cost and liability of frequent interruptions of service.



Figs. 1 and 2.—Side and End Elevations of 33,000-Volt, 50-Kilowatt, Single-Phase, Outdoor Substation.

To secure protection against overloads the carbon-tetrachloride fuse has been found entirely satisfactory in commercial service and its use is constantly increasing. This fuse consists of a carefully rated and constructed element under spring control and immersed in a carbon-tetrachloride solution hermetically sealed in a glass tube. It has splendid operating

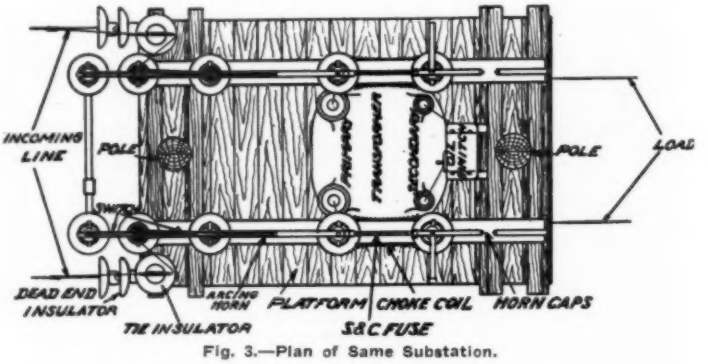


Fig. 3.—Plan of Same Substation.

characteristcs, is compact and more nearly meets the modern requirements than any other type as yet developed. This fuse is also used in connection with static or surge protectors employing a set of horn-gap dischargers and choke coil. Its function is to limit the flow of current to ground and effectually to isolate local disturbances, thus preventing their spreading to the entire system.

A commercial form of outdoor 33,000-volt, 50 kilowatt, 60-cycle single phase substation is shown in Figs. 1, 2 and 3, and has the essential features for successful commercial operation. As will be noted the transformer is mounted on a platform above the ground line, the high-tension switching and protective units are on cross-arms at the top and the secondary service-type oil switch is conveniently located near the transformer. In this particular design the high-tension switch handle is located below the platform, the reason being that a lineman when climbing the pole immediately has the fact tire structure. Between the adjustable discharge gaps and the transformer is located a heavy inductance consisting of a specially designed high-powered choke coil. The function of this inductance is to flatten an abrupt static surge or disturbance which would otherwise cause strains on the transformer. As located between the transformer and discharge gaps, the choke coil reflects surges back to the gaps where they are discharged to ground. When the gaps discharge, the carbon-tetrachloride fuses operate and prevent local disturbances communicating to the main line or generating station.

The compactness, flexibility and low cost of this type of single-phase substation will enable the taking on of small distributions which could not be made a paying investment with the ordinary type of station. It is generally admitted that the outdoor substation is now commercially feasible and its use will be greatly extended as central-station managers realize the opportunities of power along high-tension transmission lines. Electric service is needed and demanded by our rural communities and the manager who neglects this phase of the situation will simply encourage the individual plant or community station serving a group of farmers who will take up electricity supply as they have the automobile.

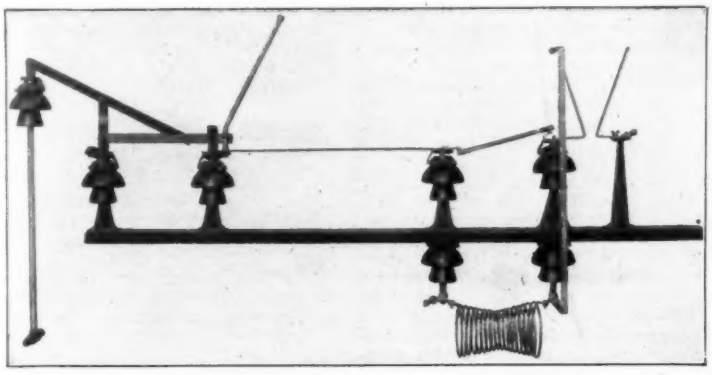


Fig. 4.—High-Tension Switch, Chemical Fuse, Choke Coil and Discharge Horns.

called to his attention that the switch is closed and the transformer energized. He can then raise the switch handle and lock it in position thus being assured that when he mounts the platform the service is "killed."

This adds to his sense of security and the non-automatic oil switch near the transformer can then be opened, eliminating any possibility of current feeding back in case of an interconnected system. After the switches are open the fuses can be replaced with safety, the oil switch closed, the pole-top high-tension switch can then be closed and service restored as he leaves the station. The sequence of operation is perfectly simple, logical and makes for greater safety.

A detailed view of the combined switch and protective unit is shown in Fig. 4. The channel-iron base is simply secured to the crossarms, as shown in the previous illustrations, and aside from serving as a mounting for the equipment also strengthens the en-

Long Run in Electric Roadster.

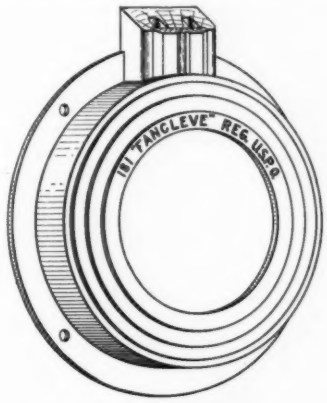
A Bailey electric roadster was driven by Mr. Whiting on May 5 from Boston to Springfield, Mass., and thence to Holyoke and back to Springfield, a total distance of 114.7 miles. This was accomplished on one charge of the battery.

The car was equipped with 54 type A-6 Edison cells with a rated capacity of 235 ampere-hours. This battery is 3.5 years old, and has gained in capacity with use and on this run 295 ampere-hours were drawn from it.

The route from Boston to Springfield involves very severe hills in the vicinity of Shrewsbury, Leicester and Spencer, which were negotiated without difficulty.

Fancleve Fixture-Canopy Extensions.

The Fancleve Specialty Company, of Jamaica Plain, Mass., has added six patterns of iron canopy extensions to its extensive line of fittings. These extensions are used to tap any fixture between the surface of wall or ceiling and the sliding canopy of the fixture and do away with the difficult and unsatisfactory method of cutting out an entrance for pipe or molding, in a spun or stamped sliding canopy. A drilled flange fastens the fitting to the surface as there is usually a concealed box at all modern outlets, so that wood screws, within the extension, could not be applied. The illustration herewith shows a terminal and the other five patterns are as fol-



Fixture-Canopy Extension.

lows: Coupling, elbow, tee, cross, and a blank without any ports, which could be cut for special conditions, or drilled for pipe. Shallow steps are cast in the face so that any sliding canopy from 3.5 to 5 inches in diameter, or any insulating ring of the same size, can be seated without projecting beyond the periphery of the extension.

Fire and Police Cable System in the Flood at Dayton.

The recent flood at Dayton, O., put to the most severe test the fire and police telegraph system of the city, and the way the underground cables and apparatus came through the ordeal is conclusive evidence of the high degree of reliability to which their manufacturers have carried their product.

The Gamewell Fire Alarm Telegraph Company had furnished the apparatus, and the cables for the system were

manufactured and installed by the Safety Insulated Wire & Cable Company, of New York. The Gamewell Company had a corps of engineers and workmen on the ground as early as possible after the flood occurred, and found the fire alarm and police signal systems entirely out of service. The central office, which is on the second floor of fire-department headquarters, escaped injury, the troubles being due to the breakdown of outside lines.

The damage to the aerial lines was very great, the poles in many cases being sheared off like pipe-stems. But the cables were not affected, except where they crossed bridges or were broken off at the boxes. As soon as the manholes were pumped out and the breaks closed, the entire fire-alarm system was in working order. The potheads used in installing the system left the cables perfectly good, except where line wires were broken when the boxes were torn from the pedestals. The ends were spliced with but little trouble and expense, making the cable system as good as new. The pedestals for the boxes stood up perfectly, not one of them being broken down by the flood which carried away trolley and electric poles everywhere.

This experience at Dayton should be an object lesson to those towns and cities which have not yet placed their fire and police cables underground, but which are courting disaster by leaving them exposed overhead.

Latest Approved Fittings

CONDUIT BOXES.—Wm. H. Hope, 33 Green Street, Newark, N. J.

Cast-iron outlet box for use with flexible-steel conduit or armored cable.

Approved March 29, 1913.

HEATERS, Electric.—V. Weber & Company, 8 Johnson Street, Newark, N. J.

"Freas" Electric Ovens, 600 watts, 110 volts; catalog Nos. 90, 100 and 110. Each of these devices consists of an oven chamber, having a wire-wound heating element regulated by a thermostat. For use on ordinary lighting circuits.

Approved April 7, 1913.

Lightning Arrester.—National Electrical Specialty Company.

HEATERS, Electric.—Hotpoint Electric Heating Company, Ontario, Cal.

Portable heating devices; sizes five, six, and seven inches; watts, 1,000, 1,200 and 2,000.

These heaters should be connected by means of proper approved fittings to wiring circuits of suitable capacity for the current required, but not for connection to ordinary lighting circuits nor ordinary lamp sockets or receptacles.

These devices present the same possibility of causing fire when combustible materials are brought in contact with the casing as commonly exists in stoves of other types. In these heaters no adequate means have been provided for eliminating this recognized hazard. In other electrical and mechanical details the devices are judged to be suitably constructed.

Approved March 18, 1913.

HEATERS, Electric.—Apex Electric Manufacturing Company, 1410 West Fifty-ninth Street, Chicago, Ill.

"N. D. Co." Soldering Iron, 65-130 watts, 110 volts.

Portable electric heating devices of this class present certain inherent hazards. The temperatures necessary for their normal use are high enough to cause fire if they are left in contact with combustible materials. As yet no adequate means have been brought forward to eliminate such hazards.

The general design and workmanship shown in the construction of this soldering iron are approved.

Approved March 18, 1913.

PANELBOARDS.—The F. Bissell Company, Toledo, O.

Approved March 13, 1913.

PANELBOARDS.—The Electrical Manufacturing Company, 1951-1953 Lawrence Street, Denver, Colo.

Approved March 10, 1913.

PROTECTORS.—The National Electrical Specialty Company, Toledo, O.

"Vac-M" lightning arresters. Signal Type No. 2.

Tests by Underwriters' Laboratories indicate that this device will not operate at 500 volts. Test records, together with records of field service to date, indicate that this device is satisfactory for the protection of railroad block-signal circuits when it is properly installed.

Approved March 28, 1913.

RECEPTACLES, For Attachment Plugs.—George Cutter Company, South Bend, Ind.

"Cutter" Stage Receptacle and Plug.

The base consists of a single piece of heavy porcelain and a hardwood plug for stage cable. For use in approved cabinets.

Approved March 18, 1913.

RECEPTACLES, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

For A. & W. Electric Sign Company, Cleveland, O.

Sign Receptacles; porcelain body with nuts for mounting screws sealed in porcelain bosses at each side.

Approved March 29, 1913.

SOCKETS, Standard.—The Arrow Electric Company, Hartford, Conn.

Approved March 6, 1913.

SWITCHES, Fixture.—The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn.

"Perkins" one ampere, 250 volts: three amperes, 125 volts; catalog No. 2551, single-pole, push-button type.

Approved March 18, 1913.

Switch Box.—Newton Hublinger.

SWITCHES, Pendent Snap.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Approved March 21, 1913.

SWITCHES, Surface Snap.—C. S. Knowles, 7 Arch Street, Boston, Mass.

"Boston F. & S." 5 amperes, 250 volts; 10 amperes, 125 volts.

Approved April 3, 1913.

SWITCH BOXES.—Newton Hublinger, 47 West Market Street, Akron, O.

"H. & B." Switch Box.

A cast-iron switch box designed for the flush mounting of surface snap switches.

Approved March 29, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

VELVA, N. D.—An electric light plant will be installed in Velva. C.

BURT, IOWA—An electric light plant will be installed here this summer. C.

ST. JOHNS, ARIZ.—O. E. Overson has a franchise to establish street lights.

GOWERIE, IOWA.—The people are planning to install an electric light plant here soon.

MOHALL, N. D.—An electric light plant is one of the possibilities for Mohall in the near future. C.

ALTON, ILL.—The City Council has decided to replace the arc lights now in use with flaming arc lamps. Z.

PLANO, ILL.—The citizens are planning to install electric lights. For particulars address the city clerk.

NODAWAY, IOWA.—An electric system will be established here. Address F. O. Welch for particulars.

SABULA, IOWA—Bonds have been voted to secure a water and light system. Address the city clerk for particulars.

ARLINGTON, ORE.—Bonds in the sum of $5,000 have been voted here for the installing of an electric light plant.

YORKTOWN, TEX.—The Yorktown Light & Ice Company will install additional equipment in its electric light plant here. D.

HOLTON, KANS.—The Council will purchase a new engine and generator for the electric system and water extension.

TECUMSEH, NEB.—$5,000 will be expended for installing electric lighting. For particulars address the city clerk.

AUBURN, KY.—An electric light and power plant will be installed shortly in the Auburn Mills to furnish electric lights for this place. G.

WADENA, MINN.—The committee appointed to raise money to install a "White Way" has received by subscription about $1,370. C.

ALMIRA, WASH.—The Washington Water Power Company has been granted a franchise for the distribution of electricity in this city.

ROANOKE, ALA.—The city will enlarge the electric light plant here. William H. Mann, mayor, is in charge of the improvement.

SAN DIEGO, CAL.—The old electric light towers now in use in this city are soon to be removed and replaced by arch lights.

WEST, TEX.—The Southern Traction Company has purchased the local light plant here, and it is said will extend and improve the service.

HOOD RIVER, ORE.—The proposition of installing a municipal lighting plant is being considered here. The estimated cost is $20,000.

ARLINGTON, TEX.—Arlington Light & Power Company has been incorporated with a capital stock of $200,000 by R. G. Carroll, W. M. Short and S. B. Cantey.

CENTRALIA, WASH.—The Independent Electric Company has been granted a franchise to erect light and power lines from Winlock to Toledo.

DALLAS, TEX.—Plans are being prepared for an electric light and heating plant that will be erected here to supply the several public buildings with light and heat. D.

FLORESVILLE, TEX.—H. B. Harmon and O. A. Sims, of Beeville, have been granted a franchise by the City Council to erect an electric light and power plant here. D.

KIMBALL, S. D.—The Kimball Electric Light and Power Company will erect a new building, install one 30-horsepower engine and one of 60-horsepower for running the dynamos. C.

ELGIN, ILL.—The City Council selected C. A. Chapman of Chicago to make estimates and first plans for a municipal electric light plant and for a street lighting system. Z.

LACONIA, N. H.—The Laconia Gas & Electric Company is planning to extend its transmission lines to Sanbornton. Address F. T. Brockington, superintendent.

SAN FRANCISCO, CAL.—The Mount Whitney Power Company has been granted permission to issue bonds in the amount of $250,000 for power-plant construction.

BOONE, IOWA.—Bids will be received by J. J. Snell, secretary, until May 30 for the furnishing of material and construction of the electric wiring and program-clock system. C.

DANVILLE, KY.—The Danville Electric Light Company is considering the extension of its lines down Shakertown pike and to the end of North Third Street in the Boyle County seat. G.

ATTLEBORO, MASS.—The Attleboro Steam & Electric Company will build an addition to its boiler plant at a cost of $15,000. Edgar Tragonings is manager of the company.

WINNIPEG, MAN.—Bids will be received May 20 for the supply, delivery and erection of two generators, exciters, switch and other apparatus. address H. H. Elliott, secretary.

LOS ANGELES, CAL.—Bids will be received until May 19 for furnishing the necessary equipment for lighting with electric lights certain streets in the Birdtown lighting district.

PONTIAC, MICH.—The city engineer has been directed to prepare estimates for placing the electric wires underground. J. Johnson, mayor, has charge of the matter.

STERLING, ILL.—The Rock River Light & Power Company has incorporated with a capital stock of $300,000. The incoporators are H. H. Wood, E. F. Lawrence and others.

FAIRHOPE, ALA.—The City Council has appointed a committee to consider the establishment of a municipal electric light plant. Address W. E. Sweet, city clerk, for information.

PARIS, TENN.—The Mayor is in charge of plans for the improvement of the electric light and power plant in this city, a bond issue of $65,000 having recently been authorized to finance the work. G.

NEWARK, N. J.—The Board of Works has approved of a resolution to change the present flaming-arc lighting system on Broad Street to a new type of arc lamp which will offer greater efficiency. A.

PORTLAND, ORE.—The City Executive Board of the City Council has adopted resolutions for the installation of a lighting system on Grand avenue, and will receive bids for same shortly. O.

BLOOMINGTON, ILL.—Residents of White's Place have formed an Improvement League, one aim of which is to install an ornamental lighting system. R. T. Lain, Ned Dolan and C. B. Hamilton are committee members. Z.

HARRISBURG, PA.—The Lackawanna Township Electric Company, now in the process of organization, has been granted the power to furnish the township of Lackawanna, Pennsylvania, with light, heat and power. N.

ROME, GA.—The Rome Railway & Light Company, of which H. J. Arnold is superintendent, will construct an extension on the east side this summer. The company is managed by S. S. Bush, Columbia Building, Louisville, Ky. G.

BELVIDERE, ILL.—The Illinois Northern Utilities Company having been granted a 20-year franchise by the City Council to sell light and power in the city, contemplates the erection of a new power plant to cost about $100,000.

TRENTON, N. J.—The Hamilton Township Committee will install new street lights on Huchinson's Mill Road, Edinburgh Road, and Quaker Bridge Street. The Public Service Electric Company will be in charge of the work. A.

DAYTON, WASH.—The Pacific Power & Light Company will build an electric power line to Turner Siding, to operate the big elevator under construction there, also a line to the Columbia County rock crusher, where electric power will be used. O.

LARNED, KANS.—Announcement has been made that the C. W. Smith Electric & Ice Company has been sold to Newton capitalists and that the new company will establish a power plant here for the proposed Arkansas Valley interurban line.

LYONS, N. Y.—The Village Trustees

have employed Horace G. Sweet, electrical engineer of Utica, to estimate the probable cost of installing a municipal lighting plant here. A year ago $10,000 was appropriated at a special election for the purpose of installing a municipal plant.

PERKIN, ILL.—The City Commission is investigating boulevard lamps similar to those used in Des Moines, Iowa, with a view to changing the system here. The Peoria Gas & Electric Company is now supplying power for 151 arc lights and 32 incandescents. Z.

VICTORIA, B. C.—The Canadian Northern Railway has applied for permission from the Government to take over and develop hydroelectric power from the Nicclum River, and will build a plant below Yale, B. C., to develop 50,000 horsepower.

PINEGROVE, PA.—When the plan to receive power from the Eastern Pennsylvania Railway Company fell through, the Pinegrove Electric Light, Heat & Power Company purchased ground and will erect its own power station and will use the power generated for local use. N.

PORTLAND, ORE.—Park Superintendent Mische has completed plans for the installation of a new and extensive electric lighting system to be installed in Washington Park. About 40 powerful lights will be installed. Bids for furnishing same will be asked for shortly. O.

LOUISVILLE, KY.—The Louisville Lead & Color Company is contemplating a change in its motor equipment so as to give alternating instead of direct-current service. R. C. Judge is in charge of the company. A new installation of alternating-current motors may be purchased shortly. G.

DEFIANCE, O.—The Defiance Gas & Electric Company has been granted permission for a stock and bond issue amounting to $314,000, proceeds to be used in improvements, expansion and reimbursements. The local improvements include the rebuilding of the electric-wire lines.

EATONVILLE, WASH.—Evans & Dickson, electrical contractors, Tacoma, Wash., have been awarded a contract by this city to select a power-plant site and supervise the construction of a power plant on the Mashell River. The proposed plant will develop 150 horsepower. O.

ELMIRA, WASH.—The City Council has granted the Washington Water Power Company a franchise to string poles and wires for the distribution and sale of electrical energy for light, heat and power, for a period of 50 years, in this city. The Company will immediately begin the construction of the line. O.

CHEHALIS, WASH.—The Lewis County Commissioners recently granted the petition of the Independent Electric Company for a franchise for a power line from Winlock to Toledo, with a branch from Cowlitz to Ethel. This means that electric power from the Chehalis plant will shortly be delivered in Toledo. O.

SAN BERNARDINO, CAL.—The Chamber of Commerce went on a record by a unanimous vote as being in favor of the city installing an ornamental lighting system in the commercial district, and using the arrowhead in some form as a part of the lighting posts. Address Councilman C. W. Smith for further information.

NIAGARA FALLS, N. Y.—The First Neighborhood Association is interested in a plan for the installation of a decorative street-lighting system in certain districts in this city. It is stated that if Governor Sulzer signs the bill permitting the installation, the city will pay one-half the cost of the improvement.

DENISON, TEX.—The Texas Power & Light Company, of Dallas, has completed preliminary arrangements for erecting a hydroelectric plant on Red River near here. This plant will supply electric power for Denison, Sherman, Paris and several other towns in North Texas and to Durant, Ardmore and other towns in Oklahoma. D.

COLVILLE, WASH.—The Stevens County Power & Light Company will begin work at once on the construction of a power line from Colville to Chewelah. The line will be a three-phase, of No. 6 copper wire on 40-foot cedar poles, carrying 33,000 volts. Substations will be built in both cities named. The undertaking approximates the expenditure of $23,000. O.

JENKINS, KY.—The Consolidation Coal Company has announced that it will extend its lines at once from its electric light and power plant in Jenkins to Shelby and Pikeville, in that section of the state, and that preparations to extend similar electrical service to Whitesburg are now being made. The district affected embraces several prosperous mining communities. G.

BELTON, TEX.—The City Electric Company, which was recently organized with a capital stock of $60,000, has taken over the holdings of the Belton Light & Power Company and the Belton Ice & Electric Company. The property consists of two electric light and power plants and an ice factory. Additional machinery and other improvements will be made to the plants. D.

STERLING, ILL.—What is to be known as the General Utilities Company is being organized by Sterling and Morrison capital for the purpose of building a gigantic hydroelectric plant on the Rock River, developing 3,000 horsepower. It is stated that $3,000,000 is back of the enterprise. It is understood that the new organization will enter Rock Island County and probably Davenport.

LAS VEGAS, NEV.—Half a million dollars is to be invested in a power-plant project destined to supply electric light and power to this city and adjoining valleys. The water for developing the power is to come from the Charlestown mountain range above Indian Springs, its source being 11 small springs. The enterprise is backed by Ira McFarland and Eastern associates, and it is planned to start work on the power plant at once. It is planned to develop several thousand horsepower.

SATTLEY, CAL.—The Mountain Development Company will begin construction by June 15 of its reservoir and power plant on Berry Creek, near Sattley. The plans for the project, which will cost $180,000, call for a main reservoir in Wild Bill Canyon. There is a fall of 1,385 feet from the reservoir to the site of the power plant in the valley below and approximately 3,500 horsepower will be developed. Light and power will be furnished in various towns and farms. Address Turner Lumber Company of Sattley, for desired information.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

MORGAN CITY, LA.—The Cumberland Telephone & Telegraph Company, of Louisville, Ky., will install a $50,000 metallic telephone system.

HALEDON, N. J.—The New York Telephone Company, of Paterson, will build new pole lines through the borough for telephone service. A.

HERMAN, NEB.—The Herman Telephone Company has been incorporated with a capital stock of $10,000. Charles Nelson is president of the company.

HILDA, KY.—With a capitalization of $1,000 the Hilda Telephone Company was recently incorporated. C. A. Jackson, Oliver S. Caudill and A. S. Caudill are the incorporators. G.

AURORA, ILL.—The mayor has recommended to the City Council the installation of a new police and fire-alarm system in the business district, to cost about $10,000. Z.

PIERRE, S. D.—The Revillo Farmers Telephone Company has been incorporated with a capital stock of $5,000 by Hugh Hay, Fred C. Biersacher, Charles Miller and Henry Brieting.

CRANSTON, KY.—The North Fork Telephone Company was recently incorporated with a capitalization of $1,000. The incorporators of the company are E. F. Reed, A. L. Tacket and T. H. Daucell. G.

MILBANK, S. D.—The Dakota Central Telephone Company is arranging to install the automatic telephone system in this place. The improvement it is estimated will cost $12,000.

LAKE GENEVA, WIS. — Lake Geneva's telephone system will be improved at a cost of $10,000. The plans call for the removal of 80 miles of wire, as well as about 11 miles of old cable.

PORT HURON, MICH.—Practically the entire telephone system in Port Huron is to be rebuilt by the Michigan Telephone Company. It is estimated that between $40,000 and $50,000 will be expended.

DECATUR, ILL.—J. P. Church, superintendent of telegraph of the Wabash Railroad, has received notice to furnish estimates of cost for installing telephones on the Springfield division between Montpelier and Chicago. Z.

PASCO, WASH.—President Klinge of the Twin City Telephone Company is authority for the statement that a new and modern telephone system will be installed in this city at once. New telephone headquarters will be constructed also. O.

JEFFERSONVILLE, IND.—The Jeffersonville City Council is seriously considering the passage of a franchise which will give the Louisville Home Telephone Company, of Louisville, Ky., directly across the Ohio River, the right to establish and operate an independent telephone exchange in Jeffersonville. G.

HILLS CITY, IDAHO—The Hills City Telephone Company ras filed articles of incorporation, with a capitallization of $5,000 for the purpose of constructing a general telephone system in Blaine County. A. C. Chipman, R. E. Micklewait, Grant Starbuck are named among the incorporators. O.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DEVILS LAKE, N. D.—Devils Lake plans to install an electric line here to operate between the city and the Chautauqua grounds.

MANHATTAN, KANS.—The Manhattan Interurban Company has plans under way for the extension of its line from this city to Topeka.

ABERDEEN, WASH.—It has been announced that Grays Harbor Railway & Light Company will spend from $15,000 to $20,000 on improvements this summer.

LAWRENCE, KANS.—J. J. Heim, of Kansas City, has been looking over the route of a proposed interurban to run out of this city to DeSoto and Linwood.

PEORIA, ILL.—The Peoria, Canton & Galesburg Company has filed articles of incorporation and will build an electric interurban between these towns.

HANNIBAL, MO.—An interurban line to Camp Point, a distance of 40 miles, is being projected, and it is stated that the Hannibal Commercial Club is lending its aid.

SAN JOSE, CAL.—Franchises for portions of the electric railroads in this city, formerly operated under county franchises, have been granted to the San Jose Railroads by the city.

EMPIRE, CAL.—The Empire Traction Company has secured practically all the right of way for an extension of its line from this city to Waterford, a distance of eight miles. T. K. Beard is president of the company.

BASSETT, KANS.—The City Council has granted permission to the Union Traction Company to construct and operate an electric railway through Bassett. D. G. Siggins is president of the company.

NAUVOO, ILL.—The Lomax Terminal Railroad Company has been incorporated by H. W. Beardsley, C. H. Kisner and others for the purpose of constructing and operating an interurban electric railway from Nauvoo to Stronghurst.

SAN FRANCISCO, CAL.—The Nevada County Narrow Gauge Railway has applied for permission to issue $500,000 in bonds. Of this amount $338,000 is desired for new construction and for changing the gauge to the standard size.

ABBEVILLE, LA.—The Louisiana Traction & Power Company, and the Southwestern Traction & Power Company have been granted franchises by the City Council for rights of way over a number of streets for their proposed electric railway lines.

TWIN FALLS, IDAHO—An electric line between Wendell and Haggerman is being promoted by J. Stewart Clark. If plans materialize, the line will be extended to Buhl, and will be a connecting link between the Oregon Short line on the north and south sides. O.

INDIANAPOLIS, IND.—The Indianapolis & Delphi Traction Company has filed a mortgage of $2,000,000 for the purpose of building an electric line from Carmel to Sheridan and Frankfort. Construction work is to begin in a few weeks.

PORTLAND, IND.—The directors of the Ft. Wayne & Springfield Railway Company, are planning to form a company to take over the bonds of the old company and advance a sufficient sum to extend the line to Portland. W. H. Fladderjohann is president.

COLUMBUS, OHIO.—The Middleport & Northeastern Railway Company has been incorporated for the purpose of constructing and operating an electric railway from Columbus to Marietta. Charles P. Outhwaite and J. C. Nickert, are named among the incorporators.

SOUDERTON, PA.—Practically the entire right of way for a proposed new double-track air line has been secured by the Lehigh Valley Transit Company. It is understood that it will be a third-rail system between Lansdale and this city. Bids have been asked for to build the 14-mile stretch from Lansdale north to Souderton, which is to be completed as soon as possible. N.

REDDING, CAL.—The California Shasta & Eastern Railroad Company, has been incorporated with a capital stock of $600,000 for the purpose of rebuilding the Anderson and Bella Vista railroad, a distance of 16 miles, and to extend it to Ingot in this county, a distance of about 12 miles. S. E. Bretherton, of Berkeley, is one of the directors.

YOUNGSTOWN, O.—The directors of the Ohio & Pennsylvania Belt Line Railroad Company have voted to begin construction work on the road from a point near Lowellville through to Haselton. The engineering work of the line, which has been in charge of D. M. Wise, is practically completed and it is expected contracts will be let and construction work begun in May.

TAYLORVILLE, ILL.—The Springfield Taylorville & Pana Interurban Railway Company has been incorporated with a capital stock of $325,000 to build an interurban railway from Taylorville to Pana. The principal office will be at Taylorville. The incorporators are W. B Adams and Albert Morgan, Taylorville, P. E. Balliet, Edinburg, and George H. Baeker and H. V. Gehm, St. Louis, Mo. Z.

PEORIA, ILL.—The Peoria, Canton & Galesburg Railroad Company has been incorporated with a capital stock of $2,000,000 to construct and operate an interurban railway from Peoria to Farmington and thence to Galesburg. The principal office will be at Peoria. The incorporators and first board of directors are James A. Lyons, Chicago, and Horace Clark, George T. Page, George C. Powers and W. R. Coleman, Peoria. Z.

KENDALLVILLE, IND.—Manager C. J. Munton of the Fort Wayne & Northwestern Railway, the new company taking the place of the T. & C. I., states that the company will spend the sum of $200,000 in improvements and equipment this season. They will change from an alternating-current to a direct-current. Three substations will be placed along the line to take care of the direct-current.

SAINT AUGUSTINE, FLA.—The St. Augustine & Palatka Rapid Transit Company has been organized with a capital stock of $2,000,000, the principal stockholders being capitalists of Washington, D. C. It is proposed to build a trolley line from St. Augustine to Palatka which will work in conjunction with the St. Augustine Public Service Corporation. The line will be 26 miles in length. The power house will be located at Hastings. J. G. Merceur, of Washington, D. C., is president of the company.

NEW INCORPORATIONS.

PORTLAND, ME.—The Dallas Electric Company has filed articles of incorporation with a capitalization of $7,000,000, to do a general lighting, heating, ice, power, water and street railway business. William E. Tucker, of Chelsea, is president.

PHOENIXVILLE, PA.—A charter has been granted to the Phoenix Water Power Company which has been incorporated for the purpose of supplying, storing or transporting water or water power for commercial and manufacturing purposes in the township of Upper Marion. The directors are E. S. Fritz, of Pottstown; S. C. Seymour, George H. B. Martin, of Camden, N. J.; and Joseph S. King, of Philadelphia. It is proposed to secure the power at Black Rock lock, Schuylkill River, in Upper Providence.

PROPOSALS.

ELECTRIC WIRING.—Sealed proposals will be received at Fort Totten, N. Y., until May 30 for the electric wiring for the new isolation ward. For further information apply to Quartermaster.

MOTOR CRUISERS.—Sealed proposals will be received at the office of the United States Engineer, Norfolk, Va., until June 2, for constructing and delivering three motor survey cruisers. For information apply to E. Eveleth Winslow, lt. col., engrs.

ELECTRIC CRANES.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 3 for furnishing two electric cranes, to be delivered at the Navy Yard, Hawaii, as per Schedule 5,423.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 3 for an electric elevator for the post office at La Crosse, Wis., in accordance with drawings and specifications, copies of which may be obtained from the Supervising Architect.

ELECTRIC LIGHT PLANT.—Sealed tenders marked "Electric Light Plant" will be received at the office of the Secretary-Treasurer of the town of Strassburg, Manitoba, Canada, until May 20 for an electric light plant for the town. Specifications may be had by applying to S. L. A. Smyth, secretary-treasurer.

MOTOR CAR.—Sealed proposals will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until May 29 for furnishing and delivering one five-passenger motor car, complete, for use in the Fire Department. Specification and form of proposal may be obtained from the Purchasing Officer.

ELECTRIC WIRING AND CONDUIT AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 16 for furnishing the electric wiring, etc., of a one-story building for the post office at Rochelle, Ill., until June 19 of a two-story building for the post office at Duquoin, Ill., in accordance with drawings and specifications, copies of which may be obtained from the custodians of the sites or from the office of the Supervising Architect.

FINANCIAL NOTES.

The Board of Supervisors of San Francisco has decided to submit to the people a bond issue of $3,500,000 for the construction and equipment of municipal railway lines to be voted upon about July 1.

C. G. Young, consulting engineer for the Southern Traction Company of Illinois, states that the company has arranged to sell approximately $7,500,000 bonds. Mr. Young pointed out that the company must complete a line from East St. Louis to Belleville by October 1. The length of the road will be 75 miles.

Bankers are offering $2,500,000 of an authorized issue of $5,000,000 one-year, six-per-cent notes of the Pacific Light & Power Company at par and interest. They mature May 1, 1914, and proceeds are to go to completing the two big power plants now under construction at Big Creek, and for 240 miles of transmission lines to Los Angeles.

A decided improvement is shown by the British Westinghouse Electric & Manufacturing Company in its report for the year 1912. Gross profits amounted to £157,871, as compared with £126,143 in 1911. The net profit, after allowing for depreciation and charges, was £41,047, as compared with £20,708.

A mortgage for $2,000,000 has been filed by the Indianapolis & Delphia Traction Company. It is the purpose of the company to build an electric line from Carmel to Sheridan and Frankfort, Ind. Construction is to begin in a few weeks, and the company is arranging for trackage rights from Carmel to Indianapolis over the lines of the Indiana Union Traction Company.

The New Orleans Railway & Light Company has sold $4,000,000 three-year, six-per-cent gold debentures, due June 1, 1916, to Bertron, Griscom & Company. Of this amount $2,500,000 will be issued immediately for payment of maturing obligations, extensions and improvements, and the remaining debentures will be sold for extensions and improvements during the next three years.

The Montreal Light, Heat & Power Company has called a special meeting of its stockholders, immediately after its regular annual meeting on June 4, to approve an increase of $5,000,000 in the capital stock of the company. This will increase the stock from $17,000,000 to $22,000,000. The company will not require the proceeds of the full $5,000,000 of new stock at present and it is not expected that more than $3,000,000 will be issued in 1913. The annual report to be made public at the meeting is expected to show the largest earnings for the stock in the history of the company.

The Brazilian Traction, Light & Power Company has made an issue of $10,000,000 six-per-cent preferred stock in London, details of which transaction were arranged by Dr. F. S. Pearson, president. There is $104,500,000 common stock issued, out of $120,000,000 authorized. The Brazilian Traction, Light & Power Company was formed last summer, by a consolidation of the Rio de Janeiro Tramway, Light & Power, the Sao Paulo Tramway, Light & Power, and the Sao Paulo Electric.

A committee composed of John F. Wallace, Henry R. Hayes and Albert M. Chambers has been named to carry out a plan for the reduction and the readjustment of the capital stock of the Electric Properties Company. The plan provides for reduction of the present outstanding common stock of the company from $6,000,000 to $4,000,000, the outstanding preferred stock to remain at $3,920,200. An issue of five-year, six-per-cent redeemable scrip of $411,533 is to be made to fund the back dividends on the preferred stock from February 1, 1910, to April 30, 1912, the dividends on the preferred from April 30, 1912, to April 30, 1913, to be paid in cash when the readjustment of capital takes effect.

The Lehigh Navigation Electric Company has accepted the offer made by Alfred D. Pardee to sell his stockholdings in the Hardwood Electric Company and the transaction has been completed. Mr. Pardee having resigned from the presidency, the operations of the Harwood Electric Company will be under the direction of A. W. Drake, vice-president and general manager, and John S. Wise, Jr., with headquarters at Hazelton, Pa. The Harwood Electric Company was incorporated in 1909 under the laws of Pennsylvania, consolidating a dozen or so electric companies, and supplies electric light and power to Hazelton, Pa., and neighboring towns. The outstanding capitalization of the company is $2,900,000 bonds, $688,000 preferred and $3,000,000 stock.

Dividends.

Central Arkansas Railway & Light Company; a quarterly preferred dividend of 1.75 per cent, payable June 2 to stock of record May 15.

Chicago Railways Company; six-per-cent dividend on Series 1 participation certificates of the company. The payment aggregates $184,800.

Federal Light & Traction Company; a quarterly dividend of 1 per cent on its preferred stock, payable May 31 to stock of record May 15.

Illinois Traction Company; has declared an initial dividend of 0.75 per cent on common stock, payable May 15, to stock of record April 30.

Kings County Electric Light & Power Company; the regular quarterly dividend on two per cent, payable June 2 to stock of record May 21.

Middle West Utilities Company; a regular quarterly dividend of 1.5 per cent, payable June 1 to stock of record May 15.

Mobile Electric Company; a quarterly preferred dividend of 1.75 per cent, payable May 15 to stock of record April 30.

Rochester Railway & Light Company; regular quarterly of 1.25 per cent on the preferred stock, payable May 31 to stock of record May 24.

Reports of Earnings.

SAN JOAQUIN LIGHT COMPANY.

The report of the San Joaquin Light & Power Company for the year ended December 31, 1912, shows net earnings of $825,810, an increase of $249,971. The income account compares as follows:

	1912.	Increase.
Gross	$1,366,087	$308,654
Expenses and taxes	540,276	58,687
Net	825,810	249,971
Total income	$864,372	$241,834
Charges, sink. fund, etc.	450,319	96,128
Surplus	$414,052	$145,706

EDISON ELECTRIC OF BROOKLYN.

The New York Public Service Commission has issued a report covering the operations of the Edison Electric Illuminating Company of Brooklyn for the year ended December 31, 1912, which compares as follows:

	1912.	1911.
Operating revenue	$5,167,669	$4,707,915
Operating expenses and taxes	3,379,343	2,928,450
Operating income	1,788,326	1,779,465
Other income	15,767	24,613
Total income	1,804,094	1,804,078
Charges	1,757,901	1,763,516
Net corporation income	46,192	40,563
P. & L. adj., debit	46,192	40,563

UNITED ELECTRIC LIGHT & POWER.

The United Electric Light & Power Company (controlled by Consolidated Gas Company) has made a report to the New York Public Service Commission for the year ended December 31, 1912, which compares as follows:

	1912.	1911.
Operating revenue	$2,601,149	$2,309,327
Expenses and taxes	1,300,264	1,213,733
Operating income	1,300,884	1,095,603
Other income	15,206	16,669
Total income	1,316,091	1,112,272
Charges	737,559	737,718
Net income	578,532	374,553
Renew. and conting.	341,295	308,338
Adj. cred.	77,160	*35,627
Previous deficit	535,231	565,810
Profit and loss deficit.	220,834	535,231

*Deficit.

NEW YORK EDISON.

The New York Public Service Commission has issued a report covering operations of the New York Edison Company for the year ended December 31, 1912, which compares as follows:

	1912.	1911.
Operating revenue	$21,024,941	$19,689,851
*Expenses and taxes.	9,361,490	8,287,463
Operating income	11,663,451	11,402,388
Other income	1,166,070	1,080,564
Total income	12,829,522	12,482,953
*Interest, rents, etc.	3,973,998	3,801,796
Net income	8,855,523	8,681,156
Dividends	3,009,204	3,009,204
Surplus	5,846,319	5,671,952
Previous surplus	23,377,489	20,381,839
Adj. credit	118,264	17,345
*Renewal and construction reserve, etc.	2,989,873	2,693,647
Profit and loss surplus	26,352,220	23,377,489

*In the 1912 and 1911 income accounts subway rents are included in item "interest, rents, etc.," and renewal and contingency reserves are included in profit and loss. In 1910 and 1909 these items are included in operating expenses.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 12	May 5
American Tel. & Tel. (New York)	127¾	128
Commonwealth Edison (Chicago)	*132	132
Edison Electric Illuminating (Boston)	260	269
Electric Storage Battery common (Philadelphia)	47¾	47¾
Electric Storage Battery preferred (Philadelphia)	47¾	47¾
General Electric (New York)	137¾	138
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅝	1⅝
Massachusetts Electric common (Boston)	16	16⅛
Massachusetts Electric preferred stamped (Boston)	73	72½
National Carbon common (Chicago)	116	116
National Carbon preferred (Chicago)	115	115
New England Telephone (Boston)	140	140½
Philadelphia Electric (Philadelphia)	22¾	22¾
Postal Telegraph and Cables common (New York)	80	82
Postal Telegraph and Cables preferred (New York)	67	67
Western Union (New York)	64¾	65
Westinghouse common (New York)	61¾	61½
Westinghouse preferred (New York)	110	100

*Last price quoted.

NEW PUBLICATIONS.

ELECTRIC RAILWAY MANUAL.—The McGraw Electric Railway Manual, issued annually in connection with the *Electric Railway Journal,* has appeared for 1913. This is a large cloth-bound volume of 341 pages, containing statistical information regarding the electric railways of the country. The "Red Book," as it is called, gives so far as is obtainable a tabulated operating report, showing income and expense accounts, for each electric railway company in North America. The statistics of traffic handled and of track and rolling equipments are given, with brief physical and financial histories of the companies and a statement of the population of the communities served. There is also a list of the securities issued with descriptions, and the names of officials of the various companies are given. Many maps are included, showing the routes of both city and interurban roads. The price of the volume is $7.50.

FOREIGN TRADE OPPORTUNITIES.

(*Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.*)

NO. 10870. CONDUITS FOR TELEPHONE WIRES.—A report from an American consular officer states that a foreign business man desires to be placed in communciation with American manufacturers of conduits for carrying underground telephone wires. He is said to be treating with the Government, which operates the telephone service of the country, for furnishing a large amount of these conduits. The most modern system will be required. Samples, prices, f. o. b. New York, and terms are requested. References can be furnished, and correspondence should be in French, Italian, German or English, the first three preferred.

NO. 10,894. SUCTION CLEANERS.—Inquiries have been made at an American consulate in a European country for American suction cleaners. Six of these have recently been ordered by the Royal Palace and have given satisfaction.

PERSONAL MENTION.

GANO DUNN has been made president of the J. G. White Engineering Corporation.

A. E. KENNELLY, of Harvard University, has been elected an honorary corresponding member of the British Association for the Advancement of Science.

W. W. FREEMAN, general manager of the Alabama Traction, Light & Power Company, has been elected a director of the Mexican Northern Power Company.

ALEXANDER GRAHAM BELL made an address on May 6 at the unveiling of the tablet in honor of Samuel Pierpont Langley at the Smithsonian Institution, Washington, D. C.

HERBERT E. IVES lectured at the meeting of the Philadelphia Section of the Illuminating Engineering Society at Franklin Institute on Friday, May 16, taking as his subject, "Some Home Experiments in Illumination from Large Light Sources."

M. LUCKIESH, of the physical laboratory of the National Electric Lamp Association, read a paper, illustrated by special apparatus, entitled "Light and Art," at the meeting of the Chicago Section of the Illuminating Engineering Society on May 14.

H. B. SMITH, head of the department of electrical engineering, Worcester Polytechnic Institute, is attending lectures in London by Professor Sir James Dewar and Sir J. J. Thomson. Professor Smith will remain abroad during the remainder of the present school year.

HOMER E. NIESZ, manager of the Cosmopolitan Electric Company, Chicago, has been appointed chairman of the Convention Committee of the Electric Vehicle Association of America to arrange for the forthcoming annual convention, which will be held in Chicago, November 4 and 5.

O. D. STREET has been appointed assistant general sales manager of the Western Electric Company, also taking up the duties of supervisor of distributing houses, succeeding F. V. BENNIS, who has accepted the position of assistant treasurer of the American Telephone & Telegraph Company. Mr. Street first became connected with the Western Electric Company in 1901. In 1903, after occupying various positions in the manufacturing and telephone sales organization, he was transferred to San Francisco in charge of telephone sales work. He returned to Chicago in 1904, shortly after becoming acting manager at Philadelphia and Pittsburgh successively. In 1905 he was made manager of the Atlanta house, remaining there until 1908, when he went to the New York offices as telephone sales manager.

O. D. Street.

EMILE BERLINER and CHARLES P. STEINMETZ will receive the Elliott Cresson medals from the Franklin Institute on Wednesday evening, May 21. Dr. Steinmetz will deliver an address on "Some Electrical Problems Awaiting Solution," and Mr. Berliner, an address on "Development of the Talking Machine."

JAMES B. ARTHUR, of the faculty of the Baltimore Polytechnic Institute, has been appointed instructor in the electrical engineering department of Lehigh University and will assume his new duties at the beginning of the collegiate year in September. He is a graduate of Lehigh and was a special student at the college in 1910.

CHARLES L. PILLSBURY, the well known consulting engineer of Minneapolis and St. Paul, and EDWARD W. BEMIS, of Chicago, have been employed by the city of St. Paul to investigate the gas, electric light, and power, and district heating public utilities of St. Paul. They will make complete physical valuations, analysis of operating expenses, and determination of rates for the city of St. Paul.

W. H. AVERELL, formerly assistant superintendent of the Pittsburgh division of the Baltimore & Ohio Railroad, has been appointed general superintendent of the Staten Island (N. Y.) Rapid Transit and Staten Island Railway systems, succeeding JAMES H. CLARK, promoted to the superintendency of the marine department of the Baltimore & Ohio Railroad. Mr. Averell will also act as assistant general superintendent of the New York division of the Baltimore & Ohio Railroad.

FRANK A. HOUSTON, formerly general manager of the New England Telephone & Telegraph Company, was elected to the treasuryship of that company at its annual meeting last week. Mr. Houston succeeds W. R. DRIVER, who resigned after 30 years of service. WILLIAM R. DRIVER, JR., of Philadelphia, becomes general manager; C. F. A. Siedhof, assistant secretary, becomes secretary to relieve E. W. LONGLEY, auditor, of his secretarial duties. E. B. WINSLOW, of Portland, Me., and CHARLES P. SMITH, of Burlington, Vt., were elected directors.

OBITUARY.

ALEXANDER D. WILBUR, father of the District Attorney of Greene County, and one of the oldest telegraph operators in the State, died suddenly of apoplexy in Catskill, N. Y., on May 5. Mr. Wilbur was 69 years of age and had been manager of the local Postal office for the last 12 years. He had been a telegraph operator for over 50 years.

THOMAS POST, president of the Berkshire Bar Association, died on May 4 at Pittsfield, Mass. Mr. Post was born in Lenox, August 16, 1834. For 21 years he was postmaster of Lenox. He was repeatedly elected a member of the Board of Lenox Selectmen, Assessors, and Sewer Commissioners. He was president of the Lenox Water Company, director of the Lenox National and Lenox Savings Banks and Lenox Electric Light Company. He was elected to the Legislature in 1863, 1868, 1882 and 1889. In 1898 he was elected Senator from the Berkshire-Hampshire District, and was re-elected in 1899 and 1900.

JOHN P. E. CLARK, one of the foremost business men in the central section of New York State, died on May 7 in Binghamton, N. Y., from Bright's disease. Mr. Clark was born in Troy, N. Y., on October 21, 1858, lived in Pittsfield, Mass., until 25, when he moved to Binghamton. He was instrumental in consolidating the street railroad lines into the present Binghamton Railway Company. He was president of the Binghamton Chamber of Commerce, general manager of the Binghamton Railway Company, secretary-treasurer of the Endicott Land Company, manager of the Waverly, Sayre & Athens Railway Company, and was interested in a dozen other concerns.

DATES AHEAD.

American Institute of Electrical Engineers. Annual meeting, New York, N. Y., May 20.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

New England Electric Vehicle Association and the Electric Motor Car Club of Boston. Joint meeting, Boston, Mass., May 20-21.

American Society of Mechanical Engineers. Spring meeting, Hotel Belvedere, Baltimore, Md., May 20-23.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 21-24.

Electrical Supply Jobbers' Association. Spring meeting, Congress Hotel, Chicago, Ill., May 26-28.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Medinah Temple, Chicago, Ill., June 2-5.

Canadian Electrical Association. Annual convention, Toronto, Ont., June 25-27.

Electrical Contractors' Association of the State of Missouri. Annual meeting, St. Louis, Mo., July 12.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16-19.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach Hotel, Ottawa Beach, Mich., August 18-21.

With the Electrical Manufacturers

Oshkosh Manufacturing Company, Oshkosh, Wis., has issued a new 32-page catalog, No. 35, covering electrical construction tools, devices and specialties of practically all kinds.

California Glass Insulator Company, Long Branch, Cal., has undertaken a contract with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to supply the latter annually for its many patrons, 3,000,000 insulators for telephone, telegraph and other electric lines.

Hartford Time Switch Company has called attention to an error which was made in a recent issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, giving its address as "Hartford, Conn." The factory moved from Hartford three years ago. All communications should be addressed to A. Hall Berry, sole sales agent, 97 Warren Street, New York City.

The Sparkless Lubricant Company, 1411 Winnemac Avenue, Chicago, Ill., has placed on the market a new commutator and brush lubricant made in the form of sticks so it can be readily applied to a warm, running commutator. The manufacturer claims it will effectively prevent sparking, cutting and heating of the commutator and brushes, if properly applied.

The Alexalite Company has published an elaborate catalog devoted to "Ideal Lighting, a Study in Perfect Illumination." This depicts the various forms of Alexalite fixtures and photographs of interiors illuminated with these fixtures, the whole work forming a very distinct addition to the classical literature of this subject. The Central Electric Company, 320 to 326 South Fifth Avenue, Chicago, Ill., is the general sales agent for the Alexalite Company.

Kuhlman Electric Company, Elkhart, Ind., recently secured, among other contracts, one from the Union Traction Company of Indiana for use at Anderson, Ind., 12 25-kilowatt and two 40-kilowatt, 33,000-volt, 25-cycle outdoor type transformers together with the 2,200-volt stepdown equipment that goes with transformers of this type. The Kuhlman Company is also building two special 25-kilowatt transformers on order of the Burlington Traction Company, Burlington, Vt.

American Sheet & Tin Plate Company, Pittsburgh, Pa., has published in illustrated pamphlet form a paper on "Copper in Steel—the Influence on Corrosion," that was read by D. M. Buck, its chief chemist, before the recent annual meeting of the American Chemical Society. It gives the results of prolonged and severe tests on copper-bearing open-hearth and Bessemer steels, which show that these resist atmospheric corrosion from one and one-half to two times as well as similar steels without the copper.

Independent Electric Manufacturing Company, Milwaukee, Wis., has issued its illustrated catalog No. 3 on the I-C controlling devices. This publication comprises some 180 loose-leaf bulletins on as many direct-current and alternating-current motor starters, speed regulators, drum type controllers, multiple-switch starters and regulators, controllers for machine tools, printing presses, elevators, self-starters, field rheostats, dynamos and other resistance units, switches, circuit-breakers, etc. Valuable data on motors and generators are also included.

Calculagraph Company, 9 to 13 Maiden Lane, New York City, has published in the form of a 38-page pamphlet the article on the "History of Time Measurement and of Time-Measuring Instruments," that was recently written for the *Keystone Magazine* by Henry Abbott, president of the Calculagraph Company. This is a classical historical sketch of horology from the earliest ages to the present time. It gives a very fair and candid account of the many scientists and practical workers in this line and of their remarkable achievements in the evolution of clocks and watches.

The Improved Equipment Company, 60 Wall street, New York City, specialist in combustion engineering, has issued bulletin No. 6 entitled "Silica Retorts and Settings for Gas Benches." It describes the manufacture and advantages of silica products as made by the American Refractories Company, especially to the designs and specifications of the Improved Equipment Company. The value of silica retorts is particularly pointed out in connection with reference to the construction and operation of the Doherty economizer bench. Much original information of high value to gas engineers is included in the bulletin.

Duncan Electric Manufacturing Company, of Lafayette, Ind., maker of the Duncan watt-hour meters, is just beginning the building of a new wing to its present already commodious factory. The addition will consist of four stories, modern in every respect and will give the company about 15,000 additional square feet of floor space. The Duncan Company has also ordered about $50,000 worth of new automatic machinery and is revamping its entire factory. It is changing over to individual-motor drive in all departments and is installing an automatic sprinkler system.

Keuffel & Esser Company, New York, N. Y., has issued a leaflet describing the Roylance electrical slide rule. This is a modification of the regular Mannheim slide rule. In addition to the standard features there is a series of scales, by means of which the different properties of copper wire, such as size, conductivity, weight, etc., may be determined without the use of tables. The current-carrying capacities of different kinds and sizes of wires are marked in a groove in the body of the rule beneath the slide. These rules are also provided with an improved type of runner and special gauge marks for the conversion of horsepower and kilowatts.

J. G. White Engineering Corporation, New York City, has entered into a contract with the San Joaquin Light & Power Corporation to undertake the engineering and construction of a 6,000-kilowatt hydroelectric plant on the Tule River near Springville, Cal., the installation of a 3,000-kilowatt generator at San Joaquin power house No. 2, a 3,750-kilowatt generator and water wheel at Kern River Canyon plant, the installation of 6,250-kilowatt steam turbine, boilers and auxiliaries and building at the Bakersfield steam plant and installation of four 666-kilowatt transformers and necessary revision of switching arrangements for plant No. 3.

General Electric Company, Schenectady, N. Y., has issued bulletin No. A-4116, which describes isolated and

small-plant alternating-current switchboard panels for three-phase circuits of 25 or 60-cycle frequency. The bulletin is illustrated with a large number of diagrams and gives comprehensive data as well as descriptions of these panels. The company has also issued bulletin A-4119, which is devoted to the application of electricity in the meat-packing industry. The bulletin describes, with the aid of numerous illustrations, the generation of electric power by means of Curtis turbogenerators and the application of this electric power to a great variety of purposes in practically all departments of large packing establishments. Of the packing plants whose electrical features are described in more or less detail are several of the plants of the Cudahy Packing Company, John Morrell & Company, North Packing & Provision Company, John P. Squires & Company and Swift & Company.

Holophane Works of General Electric Company, Cleveland, O., has issued some interesting pamphlets on some of its new illuminating glass products. One of these describes the new Sudan glass in Panelex designs. This is a medium-density opal, highly uniform in texture, satin finished inside and perfectly smooth outside. The Panelex design does not involve ridges nor valleys with sharp edges; Sudan reflectors are made for every size lamp from 25 to 500 watts. Another pamphlet on Holophane-Realites shows some of the designs of these highly efficient, entirely inclosed units for lighting stores and commercial interiors of the better class. A third pamphlet is devoted to Calla glass, an ornamental opal glass of great purity and beauty; designs are raised on the outer surface, giving the effect of an overlay which is brought out beautifully when lighted; the outer surface is soft and velvety, whereas the inner surface is given a light mirror-like polish which adapts Calla glass particularly for bowls for semi-indirect lighting and for shades for bracket fixtures.

Record of Electrical Patents.

Issued by the United States Patent Office, May 6, 1913.

1,060,576. **Key Construction and Support for Telephonic Apparatus.** W. P. Andrick, E. Lowe and H. W. Haff, assignors to K. M. Turner, Jamaica, N. Y. For switchboard use.

1,060,591. **Clock.** B. Z. Friedman, Fort Worth, Tex. Is wound by an electric motor.

1,060,598. **Apparatus for Grounding Telephone Wires.** P. T. Hudson, Everton, Mo. An electromagnetic circuit-breaker opens part of the circuit and grounds another.

1,060,600. **Connector.** B. G. Jamieson and C. A. Keller, Chicago, Ill. A stranded cable is wedged tight around a concentric cable conductor.

1,060,615. **Combined Vest-Pocket Pencil and Pen Holder and Electric Light.** E. A. Metcalf, Forbes, Mo. A pocket battery and lamp.

1,060,617. **Fuse-Holding Device.** T. E. Ray, New York, N. Y. The block has a projection of reduced thickness on one side and a recess on the other, the fuse strip being doubled over the projection with its ends in the recess.

1,060,628. **Electric Bell.** C. M. Proctor, Detroit, Mich. Has two pairs of binding-posts.

1,060,630. **Electric Time Switch.** S. G. Rhodes and A. B. Rypinski, assignors to T. E. Murray, New York, N. Y. Covers details of the mechanism, such as the stop and cam plate.

1,060,638. **Water Heater.** B. A. Schroeder, Birmingham, Ala. Includes a thermostatically and water-flow controlled electrical mechanism for turning the gas on and off.

1,060,651. **Ozone Generator.** A. L. Van Patten, Los Angeles, Cal. Has high-tension electrodes in the chamber of an air pump.

1,060,700. **Switch.** G. E. Palmer, assignor to Hart Manufacturing Co., Hartford, Conn. Controlled by two solenoids, one for closing the switch and the other for unlocking the closing means.

1,060,718. **Electric Heater.** W. Stanley, assignor to General Electric Co. A heat-storage stove in which the resistance element is inclosed in a heat conductor that is thermally insulated on all sides except the top, over which a cover fits when not in use.

1,060,721. **Apparatus for Producing Medicated Gas.** A. L. Van Patten, Los Angeles, Cal. Includes an electric ozone generator and a medicator.

1,060,722. **Commutator.** W. G. Viall, assignor to Ives Manufacturing Corporation, Bridgeport, Conn. A disk commutator for a three-coil toy motor.

1,060,724. **Reverse-Current Relay.** E. B. Wedmore and W. P. Hamlyn, assignors to General Electric Co. Has differentially wound shunt and series coils.

1,060,731. **Alternating-Current Motor.** E. F. W. Alexander, assignor to General Electric Co. Combined with a single-phase source is a polyphase motor, a phase converter having its rotor loosely mounted on the motor shaft, and a clutch for connecting the rotor and shaft.

1,060,734. **Locomotive Truck.** A. F. Batchelder, assignor to General Electric Co. The motor armatures are mounted directly on the axles.

1,060,754. **Projector Control.** J. L. Hall, assignor to General Electric Co. Includes an electric motor for training the projector and a synchronous pilot motor for operating its controller.

1,060,757. **Thermal Cutout.** C. D. Haskins, assignor to General Electric Co. A cartridge fuse with its fuse element made up out of a thin sheet partly rolled.

1,060,760. **Electric Signaling Apparatus and Circuits.** F. B. Herzog, New York, N. Y. H. Herzog, executrix of said Herzog, deceased. Includes selector mechanism for signaling any one of the stations on the line.

1,060,781. **Automatic Alarm and Signal Device.** J. D. Nelson, Cincinnati, O. Includes a relay and an oscillating switch.

1,060,785. **Methods of Laying Submarine Power and Other Electric Cables.** A. J. Pahl, Alameda, Cal. A messenger cable is first laid; this is under-run by a barge to adjust position and slack of this cable; it is again under-run, the power cable being connected to the messenger and both paid out over the stern of the barge.

1,060,822. **Method of Connecting Electric Wires to Lamp-Holders, Plugs, and the Like.** A. T. Crosher, Te Aroha, New Zealand. A two-part insulating body for sockets has strain-relief passages for each wire and terminals therefor.

1,060,832. **Storage-Battery Compound.** N. Fallek, assignor to Cook Railway Signal Co., Denver, Colo. A semi-fluid eletrolyte contains 12 parts (by weight) of 1.230 sulphuric acid, 3 parts of clean asbestos, and 1 part of 1.180 sodium silicate solution.

1,060,836. **Brake Control for Elevators.** E. L. Gale, Sr., assignor to Otis Elevator Company, Jersey City, N. J. Electric brake for an electric elevator.

1,060,839. **Electric Furnace.** D. J. Hauss, Aurora, Ind. Is supplied with both direct current and alternating current, the anode electrode being metallic and the cathode serving as a joint electrode.

1,060,851. **Passenger-Driver Telephone Signal System for Vehicles.** H. G. Pape, Buffalo, N. Y. A combined speaking tube and one-way telephone for a limousine.

1,060,868. **Electric Resistance Furnace.** L. Ubbelohde, Karslruhe, Germany. Has a spiral resistance wire surrounding a central insulating tube and a layer of carbon about the wire.

1,060,871. **Ignition-Timing Device for Magnetos.** D. M. Wilson, Muncie, Ind., assignor of one-half to F. S. Saunders. Covers details of construction.

1,060,886. **Insulator.** J. F. Bicknell, assignor to Findlay Electric Porcelain Co., Findlay, O. Composed of duplicate self-centering sections, each having a projection at one end fitting into a socket at the other end of the next section and a transverse groove to hold the wire.

1,060,894. **Dynamometer Wattmeter.** M. Dolivo-Dobrowolsky, assignor to General Electric Co. Has two concentric iron cores, a movable potential coil between them, a stationary short-circuited current coil, and a third coil in inductive relation to the current coil.

1,060,895. **Motor Starting and Protective Device.** G. T. Eagar and C. H. Williams, assignors to General Electric Co. A polyphase motor is connected to the supply first through circuit-breakers and then through fuses.

1,060,939. **Automatic Telegraph Transmitter.** L. M. Potts, assignor to A. McLanahan, Baltimore, Md. Includes mechanism for producing selective movement of a perforated sending form through the transmitter.

1,060,940 and 1,060,941. **System or Electric Motor Control.** J. C. Reed,

Steelton, Pa. The first patent provides for strengthening the field when speed becomes excessive; the second for dynamic braking.

1,060,947. Trolley. J. Risbridger, assignor of 55 per cent to Eureka Tempered Copper Works, North East, Pa. Has a brush for taking the current from the wheel.

1,060,950. Electric-Light Bracket. E. Schwarz and A. E. Schwarz, Tacoma, Wash. An extensible fixture.

1,060,953. Adapter for Electric-Lamp Sockets. G. I. Silbert, assignor to Federal Electric Co., Chicago, Ill. A pull-switch plug socket.

1,060,957. Apparatus for Producing Electrical Discharges. R. Spaulding, assignor to M. Spaulding, New York, N. Y. A fan motor forces air through passages in which there are high-tension electrodes.

1,060,966. Electric Motor and Brake. H. A. Balcome, assignor to B. F. Sturtevant Co., Boston, Mass. An electromagnet controls application of the brake.

1,060,978. Apparatus for Igniting Miners' Safety-Lamps. E. A. Hailwood, Morley, England. Electric ignition in a special chamber.

1,060,984. Recording Wattmeter. F. F. Kinney, assignor to Chicago Electric Meter Co., Chicago, Ill. Has time-controlled solenoid-actuated means for periodically printing the indications on a record strip.

1,060,718.—Electric Storage Stove with Cover.

1,060,986. Safety Switch for Electric Heaters and Other Electrical Apparatus. F. Kuhn, assignor to American Electrical Heater Co., Detroit, Mich. Clock mechanism periodically releases a detent for an automatically opening knife switch.

1,060,987. Automatically Operating Switch for Electric Circuits. F. Kuhn, Detroit, Mich. An amplification of the above.

1,060,989. Electric Terminal. F. W. Lyle, assignor to General Electric Co. A resistance compound of boron has a tungsten terminal welded to it by a boron-tungsten alloy.

1,060,991. Variable-Resistance Electric-Lamp Switch. F. C. Mapes and W. M. Owen, Chelsea, Mich. A spiral switch contact engages the turns of the coil.

1,060,992. Heater for Automobile-Radiators. L. H. Mayer, Johnstown, Pa. An electric heating coil to prevent freezing.

1,061,000. Illuminating Appliance. O. A. Mygatt, New York, N. Y. A prismatic-glass reflector is held by a shoulder in a glass ceiling bowl.

1,061,016. Process of Melting Ferro-Alloys and Keeping Them in Liquid State. W. Schemmann and J. Bronn, assignors to Rombacher Hüttenwerke, Rombach, Germany. Employs electric contact-resistance heating, a movable electrode being adjusted so that the voltage drop is not more than 30 volts.

1,061,055. Controller-Regulator. C. P. Ebersole, assignor to American Automotoneer Co., Philadelphia, Pa. Prevents starting the motors too rapidly.

1,061,065. Electric Vibrator. M. K. Golden, Detroit, Mich. Includes a vibratory-electromagnet.

1,061,169. Automatic Stop Device for Automatic Machines. R. L. Folz and P. A. Zace, Chicago, Ill. An electric stop arrangement for a machine that handles separate sheets of paper to a gauge.

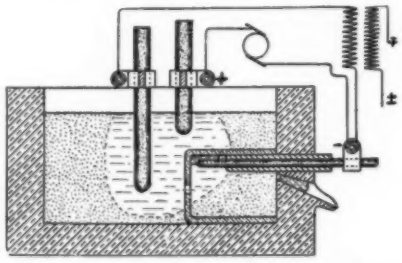
1,061,170. Electric Soldering-Iron. F. M. Giffen, San Antonio, Tex. Includes a recess for holding liquefied solder.

1,061,182. Recording Wattmeter. F. F. Kinney, assignor to Chicago Electric Meter Co. A modification of No. 1,060,984.

1,061,186. Shade-Holder. K. J. Kornbau, New York, N. Y. Includes a special latch.

1,061,191. Electrical Controlling Device. H. W. Leonard, Bronxville, N. Y. A motor-control system with variable voltage through auxiliary means.

1,061,192. Means for Controlling Electromotive Force. H. W. Leonard. Includes two opposing motors connected in series across the source.



1,060,839.—Direct-Current and Alternating-Current Furnace.

1,061,195. Metering Panel Board. A. C. McWilliams, Chicago, Ill. Has a transverse special-circuit bar that can be connected to any of a set of parallel meter bars.

1,061,225. Therapeutic Device for Utilizing Radiant Energy. S. A. Cunningham, New York, N. Y. A special reflector and screen for an electric light.

1,061,226. Safety Fuse. A. F. Daum, Pittsburgh, Pa. Relates to means for clamping the ends of the refillable fuse element in a cartridge fuse.

1,061,227 and 1,061,228. Cartridge Fuse. A. F. Daum, Pittsburgh, Pa. Cover other features of the end construction of refillable fuses.

1,061,238. Telephone Signal. A. U. Gerber, Chicago, Ill. An emergency calling signal for prepayment telephones.

1,061,251. Commutator. J. Burke, assignor to Burke Electric Co., Erie, Pa. The main portion of each segment is of an iron alloy and the trailing portion is of copper.

Patents That Have Expired.

The following is a list of electrical patents (issued by the United States Patent Office) that expired May 12, 1913.

559,792. Electric Switching Apparatus. W. W. Dean, St. Louis, Mo.

559,796. Electrically Operated Railway Switch. A. C. Goetz, Milwaukee, Wis.

559,800. Automatic Track Switch for Electric Railways. W. C. Henry, Milwaukee, Wis.

559,801. Electric Light for Bicycles. B. B. Hoffman, New York, N. Y.

559,821. Typographic Printing Apparatus. H. C. Spaulding, Boston, Mass.

559,837. Electric Telephone Transmitter. N. Bassett, Philadelphia, Pa.

559,863. Electric Arc Lamp. S. E. Nutting, Chicago, Ill.

559,869. Selective Signal and Lock-Out System. C. E. Scribner, Chicago, Ill.

559,872. System of Electrical Transportation. P. K. Stern, St. Louis, Mo.

559,874. Telephone System. W. F. Taylor. Montreal, Can.

559,889. Electric Clock. B. Franklin and D. H. Fletcher, Chicago, Ill.

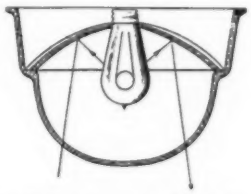
559,903. Steering Gear for Ships. M. Pfatischer, Philadelphia, Pa.

559,904. Electrical Steering Gear. M. Pfatischer.

559,907. Running Compound-Wound Generators in Multiple. W. B. Potter, Schenectady, N. Y.

559,910. Armature for Dynamo-Electric Machines. H. G. Reist, Schenectady, N. Y.

559,913. Alternating-Current System of Distribution. C. P. Steinmetz, Schenectady, N. Y.



1,061,000.—Reflecting and Diffusing Ceiling Lamp.

559,916. Electric Switch. P. G. Tismer, New York, N. Y.

559,939. Electric Cigar Lighter. W. Fisher, Chicago, Ill.

559,988 to 559,990. Telephone. T. Berdell, New York, N. Y.

560,006. Dynamo-Electric Machine or Electric Motor. O. Patin and L. Levavasseur, Paris, France.

560,031. Electric Railway. J. H. Guest, Boston, Mass.

560,035. Electric Regulator. R. M. Hunter, Philadelphia, Pa.

560,039. Electric Arc Lamp. A. O. Mackin, Anderson, Ind.

560,043. Door Handle With Electric Alarm. A. J. Moulart, Paris, France.

560,076. Electric Program-Clock. A. A. C. E. Bastos, Sao Paulo, Brazil.

560,087. Meter for Alternating Electric Currents. T. Duncan, Fort Wayne, Ind.

560,093. District-Telegraph Call Box. W. H. Garven, Portland, Ore.

560,096. Electric Call Bell. F. C. Jordan, Wadsworth, O.

560,097. Trolley Wire and Trolley Therefor. H. R. Keithley, Buffalo, N. Y.

560,102. Automatic Railway Signal System. J. W. Lattig, South Bethlehem, Pa.

560,128. Fuse Cutout. W. E. Harrington, Philadelphia, Pa.

560,168. Electric Lamp Socket. H. W. Leonard, New York, N. Y.